CANADA: GROWTH POTENTIAL OF THE GRAIN AND LIVESTOCK SECTORS

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ABSTRACT

The study examines growth potentials of the grain and livestock sectors in Canada through 1975. Foreign trade, recent changes in production, causes behind these changes, supply response to prices, and potential developments are investigated. Projections of production and export availability in 1975 are made assuming specified price levels. Beef production will increase greatly by 1975 but barely enough to meet heavy demand. Wheat production will increase somewhat from the levels of 1970 and 1971 but will not reach the levels attained during the mid-1960's. Production of coarse grains and oilseeds will continue to grow. Resources are available for substantial increases in both grain and livestock production, but are more readily available for expansion of grain production. Recent policy changes have been aimed at agricultural diversification and improved grain marketing.

Key words: Wheat; Feed grains; Beef; Pork; Foreign trade; Supply and elasticity; Canada.

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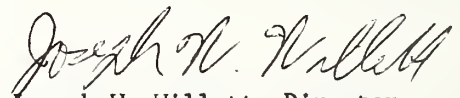
FOREWORD

This study evaluates the probable production potential of Canada's grain and livestock sectors by 1975. Similar studies have been made on Argentina and Australia. The three studies were conducted by teams of economists under the leadership of William R. Gasser, Chief of the Developed Countries Branch, Foreign Demand and Competition Division, ERS. They present a picture of trends and changes (both past and projected) in the production and trade of three of the world's major agricultural exporters and identify the major causes of the changes.



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Geographical Areas*

Western Canada:	British Columbia, Alberta, Saskatchewan, and Manitoba
Eastern Canada:	Ontario, Quebec, New Brunswick, Nova Scotia, Prince Edward Island, and Newfoundland
Atlantic Provinces:	New Brunswick, Nova Scotia, Prince Edward Island, and Newfoundland
Maritime Provinces:	New Brunswick, Nova Scotia, and Prince Edward Island
Prairie Provinces:	Manitoba, Saskatchewan, and Alberta
Other Canada:	British Columbia, Quebec, and Atlantic Provinces
Northern Ontario:	All of Ontario lying north of Lakes Superior and Huron and Georgian Bay
Eastern Ontario:	All of Ontario lying north of the St. Lawrence River
Central Ontario:	That part of Ontario lying near the north shore of Lake Ontario
Western Ontario:	That part of Ontario lying east of Lake Huron and south of Georgian Bay
Southern Ontario:	That part of Ontario stretching across the north shore of Lake Erie from the border with Lower Michigan to the Niagara Falls-Buffalo area of New York State
Southwestern Ontario:	The western part of southern Ontario
Peace River District:	An agricultural area which straddles the Alberta-British Columbia border about 450 miles north of the U.S.-Canadian border

* These delineations are shown on the maps on pages 3 and 36.

Abbreviations and Symbols

CDA:	Canada Department of Agriculture
CWB:	Canadian Wheat Board
DBS:	Dominion Bureau of Statistics The name of this Government agency was changed to Statistics Canada on April 1, 1971

Other Notes

Unless otherwise noted, all tons are metric (1 metric ton = 2,206.42 pounds).

Wheat flour expressed in terms of wheat grain implies a relationship of 1 pound flour = 1.38 pounds of grain (1 cwt. flour = 2.3 bushels of grain).

Columns in tables may not add because of rounding.

SUMMARY

Although Canada's wheat production through 1975 will be up from 1970-71 levels, it is not expected to reach levels attained during the mid-1960's. Coarse grains production will continue to increase rapidly. Beef production will increase but less rapidly than sharply increasing domestic demand. The difference will be made up more by increased imports rather than by decreased exports to the United States. Three factors will restrict somewhat the growth in beef output: Limited forage and pasture-land, herd depletion in the late 1960's, and a steady decline in the dairy herd.

Land available for expansion of cattle grazing is all in western Canada. Most of this land, which is on established farms, needs to be improved before cattle-carrying capacity can be increased. For significant increases in forage production, land would have to be cleared, pastures seeded, or cropland converted to forage. Government programs--particularly the 1971-73 forage incentive program, which has the goal of converting 4 million acres of cropland to forage--will assist in providing the needed land resources for increased beef production. Under terms of the forage incentive program, the Government will pay producers Can$10 an acre for land converted from crops to perennial forage. An impediment to seeding pastures or establishing forage is the long wait before returns are received. Seeded pasture will not yield full returns until the fourth year after seeding.

The decline that occurred in the beef cattle herd during 1965-68 will limit expansion of beef production during the early 1970's, because resources must be diverted for rebuilding the breeding herd. A continued decline in the dairy herd will mean fewer cull dairy cows available for manufacturing-beef production and fewer Holstein steers available for feeding.

Wheat production in 1975 is likely to be below the high level of the mid-1960's because of limited export opportunities, which will be reflected to the producer in restricted marketing quotas and lower prices. However, concessional credit terms, competitive with those offered by other exporters, will continue to be used to gain new wheat markets in less developed countries. A new protein-grading system, initiated in 1971, is expected to recapture traditional wheat markets that were lost during the 1960's because of improved grading and quality standards of competing exporters. In addition, production resources, including land, are available and can be easily and swiftly transferred to wheat production if export opportunities expand.

Given a continuation of recent (1967-69) grain price levels, Canadian wheat export availability (production minus domestic consumption) could approach 500 million bushels in 1975, near the high 1963-66 level. If grain prices drop 15 percent, 1975 wheat export availability might drop by one fourth--to a level a little higher than during 1967-69.

Although wheat is expected to remain the favored crop in the Canadian Prairie Provinces, several factors will contribute to continued growth of coarse grains and oilseeds there: Favorable export markets, per acre gross receipts for these alternative crops no less than those received for wheat, and Government policies which favor a lessening of the relative importance of wheat in Prairie agriculture. The principal coarse grain crop, barley, is a good alternative to wheat and its yields have been increasing more rapidly than wheat yields.

Since 1969, large exports of barley have made Canada an important competitor in world feed grain markets. Major factors behind increased exports were more competitive pricing and increased available supplies of barley. Barley exports are no longer a residual of domestic demand as they were before 1969.

If 1967-69 grain prices continue, 1975 barley production might exceed domestic consumption by some 190 million bushels--a level somewhat above the record-high export level of the 1970/71 marketing year. If prices drop 15 percent, 1975 barley production would probably be only a little higher than 1970 production and export availability would drop to less than half that expected under a continuation of recent prices. Oats production will continue to decline and domestic consumption is projected to match production in 1975.

Corn, which is grown in eastern Canada, has potential for expanding, and if prices remain at 1967-69 levels, 1975 production can be expected to be sufficiently large to cut import requirements to one-half the 1967-69 level. With a 15-percent drop in prices, however, import requirements would continue to grow.

Pork output in Canada will increase from the 1967-69 level to meet slowly growing demand. As production becomes more specialized, supply will tend to be more stable and suffer less year-to-year fluctuations than in the past. Hog production is more responsive to the hog-barley ratio than to hog prices, but there is no evidence of significant competition between pork and beef producers for productive resources. Given recent grain prices, 1975 pork production might be slightly below domestic consumption requirements. If grain prices fall 15 percent, 1975 pork production could exceed domestic demand by enough to allow net exports to increase somewhat above the 1967-69 level.

Canadian agricultural policy in recent years has emphasized agricultural diversification and improved grain marketing. The diversification effort centers on eliminating special preferences previously given to wheat relative to other crops and programs designed to encourage livestock production. For instance, the Canadian Wheat Board's grain delivery quota system is now less biased in favor of wheat, and the Prairie Grain Advance Payments Act (for farm-stored grain) has been amended to make advance payments on barley and oats more favorable relative to wheat. Livestock production in the Prairie Provinces is encouraged by the forage incentive program and various Provincial government programs.

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I. INTRODUCTION

Purpose

The purpose of this study is to determine the medium-term growth potentials (through 1975) of Canada's grain and livestock industries. The study (1) investigates patterns and trends in foreign trade; (2) identifies recent changes in the volume and patterns of production; (3) determines the casual factors behind these changes; (4) determines supply response to prices; (5) examines the potential for changes in technology, management, inputs, and the location of production; and (6) determines potential production and export availability levels for 1975, assuming specified price levels.

Background

Canada is one of the world's more important trading nations. In 1970, exports amounted to Can$16.5 billion and imports totaled Can$13.9 billion. Ten percent of the value of exports was accounted for by agricultural products, of which 57 percent were grains and grain products and 10 percent were livestock and meat products. The United States is by far Canada's most important trading partner. In 1970, the United States accounted for two-thirds of Canada's total exports and 71 percent of its imports.

Canada is second only to the United States as a supplier of wheat to world import markets, but in recent years Canada's exports and share of the world market have declined. This has led to a period of adjustment in the Canadian wheat economy: new export markets are being sought for both wheat and coarse grains; farmers in the wheat-producing area of western Canada are diversifying from wheat; and the Government is initiating new policies to encourage increased production of coarse grains and livestock.

Methods and Procedures

This study is based principally upon an extensive review of earlier studies, most of them Canadian, and an analysis of statistical trends, mostly for the 1960-70 period. In chapters V and VII, we present our own analysis of supply response to price and projections of production and export availability. Two sets of projections were made: one assuming a continuation of current (1967-69) prices and a second assuming a 15-percent drop in grain prices.

Wheat, feed grains, beef, and pork are examined. Feed grains consist almost entirely of barley, oats, and corn. Beef production and trade are considered in more detail than pork production and trade, but pork is important because it competes with beef for some resources and is important in U.S.-Canadian agricultural trade.

For purposes of analysis, Canada is divided into three basic regions: the Prairie Provinces, Ontario, and Other Canada. The Prairie Provinces region is also subdivided into its three component Provinces--Manitoba, Saskatchewan, and Alberta (fig. 1). Most wheat, barley, and oats are produced in the Prairie Provinces. Most corn is produced in Ontario. Beef production is concentrated in both the Prairies and Ontario, and hogs are raised in all three regions. Other Canada--consisting of Quebec, the four Atlantic Provinces (new Brunswick, Nova Scotia, Prince Edward Island, and Newfoundland), and British Columbia--is a residual region of relatively minor agricultural importance. Most of Other Canada's grain and livestock production is in Quebec.

The study also refers to eastern and western Canada, which are divided by the agriculturally barren and sparsely populated Pre-Cambrian Shield, which forms a large "U" around Hudson Bay. Western Canada is composed of British Columbia and the Prairie Provinces and eastern Canada of the remaining six Provinces.

II. MAJOR PATTERNS AND TRENDS IN TRADE

Canada ranks second to the United States as an exporter of wheat and flour and is important in world coarse grain trade--both as an exporter and importer. Canada is also a major source of U.S. imports of cattle, beef, and pork and a market for U.S. exports of these products. Recent trends in Canada's trade of these commodities are examined in this chapter.

Wheat and Flour

Volume, Value, and Destination of Exports

During 1960-69, Canada's share of world wheat and flour exports 1/ generally fluctuated between 20 and 25 percent (table 1). During 1965-69 (July-June years), 2/ they averaged 20.6 percent, compared with the U.S. share of 34.7 percent. The Canadian share, however, has been lower than 20 percent since the 1967 marketing year. Canada's exports of wheat and flour averaged over 11 million tons (404 million bushels) during the 1960's (table 2), but they were volatile, ranging from 8.3 million to 16.2 million tons a year. 3/

Wheat exports are very important in the Canadian economy, but their significance is declining (table 3). Wheat and flour exports brought in an average of US$745 million a year (January-December) during the 1960's. In the early part of the decade, the value of wheat exports averaged about 12 percent of total exports and 60 percent of all agricultural exports. Rapid growth in nonagricultural exports, combined with a decline in wheat exports, reduced wheat and flour's 1969 and 1970 shares to less than 5 percent of total exports and less than 50 percent of agricultural exports. Exports are more important in total wheat disposal in Canada than in the United States: during 1967-69, two-thirds of Canadian wheat disappearance was accounted for by exports, compared with 47 percent in the United States (233). 4/

1/ Unless noted otherwise, wheat trade refers to all wheat plus flour expressed in wheat-equivalent terms (Canadian statistics convert on terms of 100 lbs. of flour being equivalent to 2.3 bushels of wheat; that is, an extraction rate of 72.46 percent).

2/ Unless noted otherwise, grain trade figures are for marketing years beginning Aug. 1. Thus, 1965 refers to the 1965/66 marketing year. Non-Canadian statistics are generally for marketing years beginning July 1, and are indicated when used. Calendar years are indicated as such or denoted CY.

3/ Unless otherwise noted, all tons are metric (2,204.62 lbs.).

4/ Underscored numbers in parentheses refer to references listed at the end of this report.

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Figure 1

Table 1.--World wheat and flour exports, and U.S. and Canadian shares of the total, 1960-69 1/

Year 2/	Total exports	United States	Canada
	Million metric tons	- - - Percent - - -	
1960. . .	42.9	42.0	21.7
1961. . .	47.8	40.9	20.8
1962. . .	43.7	39.8	20.6
1963. . .	56.5	40.8	26.6
1964. . .	50.9	38.3	23.2
1965. . .	62.4	37.4	23.8
1966. . .	56.1	35.6	26.4
1967. . .	52.4	38.5	17.0
1968. . .	47.2	31.1	18.4
1969. . .	54.6	30.2	16.4

1/ Flour expressed in terms of wheat.
2/ Marketing years beginning July 1.

Sources: (232; 233).

Canadian wheat and flour exports reached record levels in the mid-1960's because of unusually large exports to the Soviet Union and Eastern Europe. However, beginning in 1967 Soviet import requirements fell and total Canadian exports dropped to 9 million tons--similar to the level of the early 1960's.

The disappearance of most of the Soviet market, which was due to improved crops in the Soviet Union, was not responsible for all of Canada's export loss. Exports to traditional customers in the developed countries were declining throughout most of the 1960's, especially during 1967-69. The drop in exports to developed countries was due to a number of factors, including increased self-sufficiency and protectionism among importers; improved quality and grading of wheat in competing wheat-exporting countries (particularly the United States, Australia, and the USSR), which made many importers unwilling to pay premium prices for Canadian wheat; and new baking technology which lowered the requirements for high-protein wheat but brought the need for minimum protein guarantees which Canada could not supply.

Types of Wheat Exported

Most of Canada's wheat exports are hard red spring wheat, which competes directly with U.S. hard red winters and springs (about 70 percent of U.S. exports). Canadian durum wheat exports have accounted for 4 to 6 percent of total wheat and flour exports in recent years. Flour's share of wheat exports has gradually declined from 18 or 20 percent in the early 1950's to 6 or 8 percent in recent years.

Quality and Grading of Wheat

Canadian spring wheats have long set the international standard of wheat quality. This holds today, and the best grades of Canadian wheat sell at premium prices on the world market. The high quality of western Canadian wheat is due to favorable growing conditions, strict control of seed varieties, and an exacting grading system that includes a large number of grades, each specified by quite narrow margins. In recent

Table 2.--Canada's wheat and flour exports, by principal markets, 1960-70 1/

Year 2/	Developed countries					Central plan countries					Less developed countries 5/	Total 6/	Bagged seed wheat	Total 7/
	United Kingdom	EC	Japan	Other 3/	Total	Mainland China	USSR	Eastern Europe 4/	Cuba	Total				
	1,000 metric tons													
1960. .	2,498	2,091	1,514	608	6,711	944	204	602	22	1,773	951	9,434	180	9,614
1961. .	2,339	1,745	1,337	572	5,993	1,959	--	611	--	2,507	1,092	9,653	80	9,744
1962. .	2,439	1,489	1,214	636	5,778	1,536	--	612	--	2,149	984	8,909	109	9,018
1963. .	2,472	1,767	1,356	576	6,171	1,124	5,017	2,349	403	8,895	1,039	16,102	79	16,181
1964. .	2,181	1,336	1,365	353	5,235	1,697	278	1,907	401	4,284	1,322	10,839	36	10,875
1965. .	2,137	1,311	1,349	444	5,241	2,015	5,487	902	636	9,040	1,617	15,897	22	15,919
1966. .	1,990	1,369	1,640	610	5,609	2,462	2,537	829	531	6,361	2,037	14,005	20	14,024
1967. .	1,768	1,186	1,112	263	4,329	1,416	1,334	394	483	3,627	1,172	9,127	18	9,145
1968. .	1,585	1,245	1,178	272	4,280	2,231	47	203	387	2,868	1,158	8,305	18	8,324
1969. .	1,480	1,123	1,063	336	4,002	1,772	1,286	222	517	3,797	1,581	9,380	50	9,430
1970 8/	1,784	1,613	1,089	458	4,945	2,404	329	95	449	9/3,357	3,513	11,815	26	11,840
	Percent													
1960. .	26.5	22.2	16.0	6.4	71.1	10.0	2.2	6.4	0.2	18.8	10.1	100.0		
1961. .	24.2	18.1	13.9	5.9	62.1	20.3	--	6.3	--	26.6	11.3	100.0		
1962. .	27.4	16.7	13.6	7.1	64.8	17.2	--	6.9	--	24.1	11.0	100.0		
1963. .	15.4	11.0	8.4	3.5	38.3	7.0	31.2	14.6	2.5	55.2	6.5	100.0		
1964. .	20.1	12.3	12.6	3.3	48.3	15.7	2.6	17.6	3.7	39.5	12.2	100.0		
1965. .	13.4	8.3	8.5	2.8	33.0	12.7	34.6	5.7	4.0	56.9	10.2	100.0		
1966. .	14.2	9.8	11.7	4.3	40.0	17.6	18.1	5.9	3.8	45.4	14.5	100.0		
1967. .	19.4	13.0	12.2	2.9	47.4	15.5	14.6	4.3	5.3	39.7	12.8	100.0		
1968. .	19.1	15.0	14.2	3.2	51.5	26.8	0.6	2.4	4.7	34.5	13.9	100.0		
1969. .	15.8	12.0	11.3	3.6	42.7	18.9	13.7	2.4	5.5	40.5	16.9	100.0		
1970. .	15.1	13.7	9.2	3.9	41.9	20.3	2.8	0.8	3.8	28.4	29.7	100.0		

-- means zero or less than one-half a unit.
1/ Wheat flour expressed in terms of wheat.
2/ Marketing years beginning Aug. 1.
3/ Includes Europe other than the United Kingdom and the EC; United States; Australia; New Zealand; and South Africa.
4/ Includes Yugoslavia.
5/ All of Latin America and the Caribbean except Cuba, all of Africa except South Africa, and all of Asia except Japan and Mainland China.
6/ Excluding bagged seed wheat.
7/ Including bagged seed wheat.
8/ Preliminary.
9/ Includes shipments to North Korea.

Sources: Calculated from (213; 220).

Table 3.--Value of Canada's wheat and flour exports and their shares of total exports and of agricultural exports, 1960-70

Calendar year	Value	Share of total exports	Share of agricultural exports
	U.S.$1 million	Percent	
1960. . .	487	9.0	51.5
1961. . .	713	12.6	59.5
1962. . .	616	10.7	55.7
1963. . .	786	12.5	61.1
1964. . .	1,040	13.9	64.8
1965. . .	838	10.6	56.2
1966. . .	1,058	11.4	60.7
1967. . .	742	7.2	53.3
1968. . .	687	5.6	52.4
1969. . .	487	3.6	43.0
1970. . .	722	4.5	45.0

Sources: (137; 211).

years, more than 500 grades have been available (178). The principal grades are established by law--The Canada Grain Act 5/--and are referred to as statutory grades. Standards for other grades, called commercial, are reestablished every year. The highest standards are set for No. 1 Canada Western Red Spring Wheat. 6/ Through the 1970/71 season, the most important export grades were No. 1 through No. 4 Manitoba Northern Wheat and No. 5 Wheat (a commercial grade). The bulk of exports was grades 2 through 4. There are also exacting grades for durum and other classes of wheat.

One of the more important characteristics of wheat, in regard to milling and baking requirements, is the level and variability of protein content. Canadian wheats have a reputation for their high protein content, and only in recent years have some Russian wheats surpassed Canadian wheat in this regard. Protein content of Prairie wheat averaged 13.6 percent for the 40-year period 1927-66, but the annual averages ranged widely, from 11.4 to 15.1 percent. Protein content also varied widely from place to place within the Prairies (133, pp. 61-62).

New baking methods, particularly the Chorleywood Bread Process, allow the mixture of much larger proportions of soft wheat in flour used for bread manufacture. During the 1960's, this process came into widespread use in the United Kingdom and was introduced on the Continent and in Southeast Asia. The success of this and similar new

5/ A revised version of the 1930 Act became effective Apr. 1, 1971.

6/ A new grading system was introduced Aug. 1, 1971. As of that date, a new grade, No. 1 Canada Western Red Spring Wheat, composed of the old No. 1 and No. 2 Manitoba Northern, went into effect. The new grade will be segregated to protein levels of 12, 13, 14, and 15 percent. The old grades will be phased out gradually. In Aug. 1972, two more new grades, No. 2 and No. 3 Canada Western Red Spring Wheat, will be introduced. They will replace the old No. 3 and No. 4 Manitoba Northern and No. 5 Wheat grades. The new No. 2 Canada Western will be segregated by protein levels. (From an information bulletin issued by the Board of Grain Commissioners for Canada, Mar. 31, 1971.)

methods requires a close tolerance on protein levels of the hard wheat in the grist. Because the United States, Australia, and the USSR offered wheat with guaranteed minimum protein levels, Canadian wheat--whose protein level varied from shipment to shipment--was at a disadvantage in markets utilizing the new baking process. Canada's exports to countries demanding constant protein levels, particularly Britain, declined. Canadian wheat, however, retained its quality advantage in markets using less sophisticated baking methods. Furthermore, markets lost because of the protein problem may now be regained, since a protein-grading system has been established (100).

Principal Markets

Canada's wheat and flour export markets are now much more diversified than they were during the 1950's, when 80 percent of exports were destined for developed countries. The 1960's brought large markets in the central plan countries (including Cuba) and a decline in exports to the developed countries. Wheat and flour exports to less developed countries (LDC's) were of relatively minor importance through the 1960's, but they increased greatly in 1970. 7/

Since 1960, import markets for Canada's wheat grew most rapidly in the LDC's, fluctuated quite a bit in the central plan countries, and remained more or less stagnant in the developed countries. In the early 1960's, Canada was the principal shipper of wheat to the developed countries, supplying about 40 percent of those markets' imports. In recent years, however, Canada's share of the developed country market dropped to less than 30 percent. Canada presently supplies about one-third of the market in central plan countries. Canada supplies only a small proportion (6 percent in 1969) of LDC import needs but is trying to increase its share of this market segment, which accounted for 47 percent of world wheat imports in 1969.

Among the developed countries, Canada's principal markets are the United Kingdom, the European Community (EC), and Japan, which together accounted for 38 percent of Canada's total wheat exports in 1965-69. Switzerland, Norway, Ireland, and South Africa are also important markets.

Mainland China and the USSR are Canada's principal wheat markets among the central plan countries. Since 1968, Mainland China has been the largest single market for Canadian wheat. In some years, East European countries (excluding the USSR) also import substantial quantities of Canadian wheat, and Cuba has become an important and growing market. Canada's first wheat sale to North Korea was announced in April 1971. In recent years, the central plan countries have accounted for about 40 percent of Canadian wheat and flour exports, or 3 to 4 million tons a year.

The less developed countries, as a group, usually account for about 40 to 50 percent of world imports of wheat and flour. The United States is the principal supplier, with about 50 percent of the market. Canada supplied only 4 to 9 percent of the LDC market during the 1960's, but will probably supply much more during the 1970's. Relatively high Canadian exports to the LDC's in 1965 and 1966 were due to increased food aid shipments to India and Pakistan. Efforts were made, beginning in 1969, to improve sales in LDC markets. The success of these efforts became apparent during the 1970/71 marketing year, when 29 percent of Canada's total wheat and flour exports went to LDC's (49; 95; 226).

Canada's 1969 and 1970 wheat and flour exports to less developed countries are shown in table 4. Over half of 1969 exports were food aid shipments, while commercial sales accounted for only 25 percent. Canada's new LDC credit program accounted for 23

7/ See table 2 for identification of developed, less developed, and central plan countries.

Table 4.--Canada's wheat and flour exports to less developed countries, 1969 and 1970 1/

Destination	Quantity					LDC shares	
	1969				1970 2/		
	Commercial	LDC credit program	Food aid	Total	Total	1969	1970
	1,000 metric tons					Percent	
India	53	--	396	449	446	28.4	13.3
Brazil	--	--	--	--	423	--	12.0
Egypt	--	87	16	103	396	6.5	11.3
Algeria	--	--	42	42	393	2.7	11.2
Iraq	--	--	28	28	371	1.8	10.6
Syria	--	110	5	115	290	7.3	8.3
Peru	--	169	4	173	263	10.9	7.5
Philippines	--	--	--	--	164	--	4.7
Pakistan	--	--	62	62	111	3.9	3.2
Turkey	--	--	--	--	96	--	2.7
Commonwealth America 3/	85	--	--	85	95	5.4	2.7
Ghana	52	--	14	66	69	4.2	2.0
Tunisia	--	--	48	48	58	3.0	1.7
Others	198	--	212	410	318	25.9	9.1
Total	388	366	827	1,581	3,513	100.0	100.0

-- means zero or less than one-half a unit.

1/ Year beginning Aug. 1. Does not include bagged seed wheat.

2/ Preliminary.

3/ Barbados, Jamaica, Guyana, Trinidad and Tobago, and all British dependencies in the Western Hemisphere.

Source: (221).

percent of 1969 wheat and flour sales to LDC's and is a major factor behind the jump in exports to the less developed countries during the 1970/71 marketing year. The program, initiated in June 1969, provides for long-term credit at subsidized interest rates to a Government-approved list of approximately 40 LDC's. Sales under the program have been made to Peru, the Philippines, Syria, Brazil, Egypt, and Algeria.

Coarse Grains

Canada is an exporter and an importer of coarse grains. Surplus grains from the Prairie Provinces, mostly barley but also oats and rye, are exported. Eastern Canada, however, is a feed deficit area and imports of U.S. corn supplement feed grain grown locally and that obtained from the Prairies. In 8 out of 10 years during the 1960's, the volume of barley, oats, and rye exported exceeded the volume of corn imported (table 5).

Table 5.--Canada's trade in coarse grains, 1960-70

Year 1/	Exports				Imports	
	Barley	Oats 2/	Rye	Total barley, oats, rye	Barley malt 3/	Corn
	1,000 metric tons					
1960	904	30	66	1,000	123	544
1961	798	41	111	950	136	751
1962	229	317	186	732	105	792
1963	904	270	140	1,278	118	595
1964	713	227	123	1,063	93	453
1965	734	235	204	1,174	94	607
1966	1,157	59	253	1,468	118	581
1967	786	48	121	955	116	806
1968	462	35	108	604	113	856
1969	1,801	75	97	1,973	122	762
1970	3,750	202	227	4,179	160	267

1/ Years beginning Aug. 1. 2/ Does not include seed or by-products. 3/ Grain equivalent. One kg. of malt = 1.333 kg. of grain barley.

Sources: (143, 214, 220).

Exports

Canadian coarse grain trade in world markets 8/.--Canada was the world's fourth largest exporter of coarse grains in 1969, following the United States, Argentina, and the EC. In 1968, Canada ranked ninth. Canada's share of world coarse grain exports was 4 percent or less during the 1960's--a drastic decline from its 18-percent share in 1949-53 (99). Canadian exports improved in 1969 and 1970, however, and are likely to be somewhat higher through the 1970's than in the previous decade.

Barley is the mainstay of Canadian coarse grain exports, usually accounting for three-quarters or more of the total (table 5). Barley's share was 90 percent in 1970.

8/ Unless noted otherwise, coarse grains trade refers to corn, sorghum, barley, oats, and rye, and includes only the grain. Grain products, like malt, are not included.

Coarse grain trade in Canada's economy.--Exports are not as important in the disposition of Canadian coarse grains as they are for wheat. Barley and malt exports amounted to 16 percent of barley production during 1964-68 but rose to 41 percent in 1970. Oats exports are of less importance--only 2.4 percent of Canadian oats production was exported during 1964-68. Rye exports accounted for about 44 percent of total output. In CY 1970, total Canadian coarse grain exports were valued at US$161 million. 9/ Of this, barley and malt accounted for US$139 million; oats for US$12 million; and rye for US$6 million. 10/ During 1965-69, barley exports (including malt) averaged US$51 million, or 3 to 5 percent of total agricultural exports. Barley export increases in 1970 were due to lower, more flexible export prices, poor feed grain crops in Europe in 1970, and a poor corn crop in the United States that year.

Types and quality of exports.--Approximately 85 to 90 percent of Canada's grain barley exports are feed barley grades. The remainder is barley for malting. In addition, substantial quantities of barley malt are exported.

As with wheat, the highest barley grades are determined by statute. These are No. 1, No. 2, and No. 3 Canadian Western (C.W.) 6-row Barley, and No. 1 and No. 2 C.W. 2-row Barley. Important commercial grades are No. 3 C.W. 2-row, and No. 1 and No. 2 Feed Barley. 11/ The statutory grades are most commonly used for malting and milling (for pot barley and pearled barley); the others are used mainly for feed. Most exports consist of No. 1 and No. 2 Feed.

Principal markets for barley and malt.--During 1964-68, over 90 percent of Canada's grain barley exports went to developed countries, but in 1969 and 1970 the proportion fell a little (table 6). The EC, Japan, the United Kingdom, and the United States are the principal customers. The proportion of exports going to the United States and the United Kingdom tended to decline, while that going to Japan and the EC has increased. The volume of exports going to each of these markets varies greatly from year to year. Other developed country markets for Canadian grain barley are Spain, Austria, Norway, Denmark, Australia, New Zealand, and Ireland, which in total accounted for only 5 percent of grain barley exports during 1965-69.

Except for a few years in the early 1960's, exports to central plan countries have been relatively minor. Exports to Mainland China were as high as 400,000 tons (about 20 million bushels) in 1960 and 1961, but no grain barley has been exported there since 1964. Poland purchased 104,000 tons (4.8 million bushels) in 1969 as the result of an arrangement allowing the substitution of barley for wheat in the extension of a long-term wheat agreement negotiated in 1966.

Canada's grain barley exports to less developed countries are of minor importance. During 1964-68, they amounted to only 6.5 percent of all such exports, but they rose to 9 percent of a much higher volume in 1970. Since 1964, Canada's principal LDC barley market has been Israel, which accounted for 91 percent of all grain barley exports destined for LDC's during 1964-68. Israel's share dropped in 1970, when Iraq, Taiwan, Syria, and Colombia became important markets.

Canadian malt exports are very stable and fluctuated little during the 1960's. Principal markets have been in Latin America and the Caribbean (a large number of countries), the United States, Japan (which has become an important market within the past 5 years), the Philippines, and in some years, the United Kingdom.

9/ Barley, buckwheat, corn, seed oats, mixed feed oats and scalpings, oats, rye, cornmeal, malt, and oatmeal.

10/ Oats exports include seed oats, mixed feed oats and scalpings, and oatmeal.

11/ Nonstatutory grades whose standards are redefined every year.

Table 6.--Percentage distribution of Canada's grain barley exports, by principal markets, 1960-70 1/

Year 2/	Developed countries						Central plan countries	Less developed countries	Total
	United States	United Kingdom	EC	Japan	Other	Total			
	Percent								
1960. .	29.0	20.9	0.5	--	0.4	50.8	49.0	0.1	100.0
1961. .	26.5	20.2	.2	--	--	46.9	52.6	.5	100.0
1962. .	21.2	64.6	--	--	3.9	89.7	10.3	--	100.0
1963. .	20.9	23.0	.4	8.8	.4	53.5	42.7	3.8	100.0
1964. .	23.6	30.0	7.4	27.0	3.4	91.4	6.1	2.5	100.0
1965. .	13.9	14.0	40.7	18.0	3.9	90.5	--	9.5	100.0
1966. .	13.9	17.5	31.0	19.8	11.4	93.6	1.5	4.9	100.0
1967. .	12.1	5.4	26.6	42.8	3.6	90.5	--	9.5	100.0
1968. .	36.2	51.3	--	3.6	2.4	93.5	--	6.5	100.0
1969. .	12.5	23.6	24.2	20.5	2.6	83.4	5.8	10.8	100.0
1970. .	4.9	17.1	43.6	14.9	7.6	88.1	2.6	9.3	100.0

-- means zero or less than one-half a unit.

1/ Grain barley only.
2/ Marketing years beginning Aug. 1.

Sources: (214; 220).

Principal markets for oats and rye.--The principal export markets for oats are the EC and the United States. Smaller amounts are usually exported to the United Kingdom, Ireland, and Switzerland. Other markets are irregular. Japan takes approximately half of Canadian rye exports. Other important customers are the United States, the United Kingdom, the EC, and Norway.

Grain Corn Imports

The only coarse grain imported into Canada in substantial quantities is corn, virtually all of which comes from the United States. Since 1960, corn imports have varied from year to year, but up to 1969 there was a slight tendency for imports to increase (table 5). The average level of imports during 1960-69 was 675,000 tons (27 million bushels).

Most U.S. corn exports to Canada are destined for use in Ontario and Quebec, although approximately 51,000 tons (2 million bushels) go to British Columbia and an even smaller amount goes to Manitoba. A study of corn use in Canada determined that in 1966/67, 24 percent of imported corn was fed to Ontario livestock, and 41 percent was consumed by industrial users--mainly distilleries and cornstarch manufacturers. More than half of Canadian corn is consumed on the farms where grown, so imports from the United States generally account for more than half of the corn entering commercial channels in Canada. Imported corn is particularly important in Quebec and the Maritimes, where it accounts for over 75 percent of corn fed to livestock. In Ontario, less than 10 percent of corn fed to livestock is imported (143; 147).

Canada imposes a tariff of 8 cents a bushel on corn imports, but there are no other restrictions to trade. Most imports are shipped by lake vessels from Chicago or Toledo. This gives imported corn the advantage of utilizing the transfer grain elevators on the Great Lakes and the St. Lawrence River--an advantage not available to Ontario corn producers (143, p. 21).

Cattle and Beef

Trade in live cattle and beef is important in Canada's beef industry. Both are exported and imported in substantial quantities. Most of the live cattle trade is with the United States. Beef exports go mainly to the United States, but the bulk of beef imports originates in Oceania. Trade with the United States is substantial in terms of the size of the Canadian market, but is of relatively minor importance to the U.S. beef industry. In 1970, Canadian exports of live cattle and calves amounted to US$49 million and those of beef, to US$48 million. Imports amounted to US$16 million for cattle (higher than usual) and US$72 million for beef and veal. 12/

Cattle and Calves

Canadian trade in live cattle and calves during 1960-70 is summarized in tables 7 and 8. The volume of exports is many times that of imports, and the amount of trade fluctuates widely from year to year. With the exception of exports of purebred and dairy cattle, almost all of this trade is with the United States.

12/ Does not include re-exports of beef and veal.

Table 7.--Canada's exports of cattle and calves to the United States and other countries, by class of animal, 1960-70

Year	Purebred, & dairy weighing over 200 lbs.		Veal calves 1/		Feeder cattle 2/		Slaughter and heavy feeder cattle 3/		Total		
	U.S.	Other	U.S.	Other	U.S.	Other	U.S.	Other	U.S.	Other	All countries
	1,000 head										
1960. .	34	3	31	--	139	--	65	--	269	4	273
1961. .	37	7	29	--	332	--	97	--	495	8	503
1962. .	33	7	36	--	343	--	73	--	485	7	492
1963. .	29	6	35	--	156	--	52	--	272	7	279
1964. .	31	8	49	--	88	--	47	--	214	8	222
1965. .	34	19	61	--	357	--	141	1	593	20	613
1966. .	39	15	106	--	282	--	94	--	522	15	537
1967. .	25	13	86	--	120	--	18	--	249	13	262
1968. .	31	13	137	--	113	--	59	--	339	14	354
1969. .	47	12	127	--	14	--	43	--	230	12	242
1970. .	67	21	127	--	7	--	24	--	225	22	247

-- means zero or less than one-half a unit.

1/ All calves, except purebred, less than 200 lbs.
2/ All cattle, except dairy and purebred, 200 to 699 lbs.
3/ All cattle, except dairy and purebred, 700 lbs. and over.

Sources: (198; 211).

Table 8.--Canada's imports of cattle and calves from the United States and other countries, by class of animal, 1960-70

Year	Purebred and dairy		All other classes 1/		Total		
	U.S.	Other	U.S.	Other	U.S.	Other	All countries
	1,000 head						
1960.	2	--	7	--	9	--	9
1961.	3	--	1	--	4	--	4
1962.	3	--	1	--	3	--	4
1963.	3	--	1	--	3	--	4
1964.	4	--	33	--	37	--	37
1965.	3	--	2	--	5	--	5
1966.	3	--	6	--	9	--	9
1967.	3	--	28	--	31	--	31
1968.	4	--	2	--	6	--	6
1969.	5	1	2	--	7	1	8
1970.	3	1	47	--	52	1	52

-- means zero or less than one-half a unit.

1/ Mostly slaughter cattle.

Sources: (198; 208; 212).

U.S. import duties on calves (cattle weighing under 200 pounds) and slaughter cattle (all cattle 700 pounds and over) are 1.5 cents a pound. 13/ The U.S. duty on feeder cattle (cattle weighing 200 to 699 pounds) is 2.5 cents a pound. Canadian import duties on all live cattle, except dairy cows and purebred cattle, is 1.5 cents a pound. There are no other restrictions on U.S.-Canadian trade.

Veal calves.--The United States is virtually the only market for Canadian veal calf exports. 14/ Exports increased rapidly during 1960-67 and leveled off after 1968. Exports in 1969 of 127,000 head were equivalent to 14 percent of the total Canadian calf slaughter that year. Most of the exports are 5- or 6-day-old Holstein calves from Quebec and Ontario. In 1968, 70 percent of calf exports originated in Quebec and 16 percent in Ontario. The principal market is a small number of buyers in New York State who raise the animals to 500 or 600 pounds for New York City and other east coast markets.

Feeder cattle.--Canadian feeder cattle 15/ exports, practically all of which are destined for the United States, fluctuate greatly from year to year. Eastern Canada sometimes imports U.S. feeder cattle, but the volume is insignificant. Canada's

13/ This duty increases to 2.5 cents a pound when calf imports exceed 200,000 per fiscal year and when slaughter cattle imports exceed 400,000 per fiscal year (with a maximum of 120,000 per quarter). Imports from Canada, however, have never come close to reaching this volume.

14/ A small number of cattle of all categories goes to St. Pierre et Miquelon.

15/ Cattle weighing 200 to 699 pounds. This category includes a small number of veal calves and excludes feeder cattle weighing more than 700 pounds, but it is the best approximation available from trade statistics.

exports consist mostly of heifers 6 to 8 months old and weighing 400 to 500 pounds, primarily because there is a smaller price spread between heifers and steers on the U.S. market. As indicated below, in most years during 1960-70, feeder cattle exports were large in relation to Canadian domestic feeder cattle sales:

Year	Feeder cattle exports as a percentage of domestic feeder cattle purchases, 1960-70 1/
	Percent
1960	40.0
1961	83.8
1962	91.3
1963	39.1
1964	18.8
1965	68.2
1966	52.3
1967	20.9
1968	21.2
1969	2.8
1970	1.5

1/ Exports of cattle, other than purebred, weighing 200 to 699 pounds.

Source: Calculated from (198).

The United States also imports some cattle for feeding weighing over 700 pounds (these are included with slaughter cattle in table 7). One advantage of importing heavier cattle is the lower duty (1.5 cents a pound versus 2.5 cents for lighter cattle) (14, p. 157; 49, pp. 154-56).

Most Canadian feeder cattle exports move from the Prairie Provinces to the upper midwestern United States. Heavy feeders (those over 700 pounds) move from southern Alberta to Washington and Oregon. The wide fluctuations in feeder cattle exports reflect discrepancies between U.S. and Canadian cattle inventory and cattle feeding cycles. Generally speaking, the wider the gap between U.S. feeder prices and those in western Canada (that is, the higher U.S. prices are relative to Canadian prices), the larger the volume of trade. The demand for feeders in the U.S. market (reflected in U.S. price levels) places a floor below which prices in Canada cannot fall. Table 9 shows the relationship between feeder cattle prices in Calgary and Kansas City and Canadian exports of feeder cattle. Note that a wide price differential prevailed in 1961, 1962, 1965, and 1966, when exports were unusually high. Lower price differentials in 1964 and 1969 corresponded with low exports. The declines in the price differential and exports in 1969 reflect the heavy demand in western Canada for beef heifers for herd expansion and the demand for feeders generated by large supplies of surplus grain. Exports are expected to recover somewhat before 1975.

Slaughter cattle.--Canada and the United States carry on a two-way trade in slaughter cattle. In most years, Canada's slaughter cattle exports, almost all of which go to the United States, are lower than feeder cattle or veal calf exports. Between 1960 and 1970, Canada was a net importer of slaughter cattle only in 1967 and 1970. During 1960-69, slaughter cattle exports varied from 1 to 4 percent of total Canadian cattle slaughter, and imports never equaled more than 1 percent of slaughter.

Table 9.--Canada's feeder cattle exports related to Kansas City-Calgary price differentials, 1960-69

Year	Price differential 1/	Exports 2/
	Canadian dollars	1,000 head
1960	2.94	139
1961	3.80	332
1962	2.24	343
1963	1.56	156
1964	0.56	88
1965	2.24	357
1966	2.64	282
1967	.27	120
1968	1.37	113
1969	.19	14

1/ Average price of all feeders, Kansas City, less price of good feeder cattle in Calgary.
2/ Cattle, except purebreds, weighing 200-699 pounds.

Source: Calculated from tables 7 and 41.

U.S.-Canadian slaughter cattle trade varies from year to year and, as with feeder cattle trade, depends upon relative prices in the two countries. Most Canadian slaughter cattle exports move from southern Alberta to the Pacific Northwest of the United States. Imports are principally from the Midwest to Ontario, particularly Toronto. Exports of slaughter cattle occur when Canadian marketings are higher than the domestic market will absorb. When this happens, the Canadian price drops and exports increase. The U.S. price forms a floor, below which Canadian prices will not drop. Less often, Canadian fed cattle may be in short supply, driving prices up until it is profitable to import cattle for slaughter from the United States. In this case, U.S. prices form a ceiling, above which Canadian prices cannot move. Since 1960, this has happened during only three periods--the spring of 1964, the winter of 1966-67, and the winter of 1970-71.

Beef and Veal

Canadian trade in beef and veal during 1960-70 is summarized in tables 10 and 11. During this time, Canada changed from a net exporter to a net importer of beef and veal, primarily because of growth in imports of boneless beef and veal from Oceania. Only since 1966 have Canadian trade statistics separated boneless from other fresh and frozen beef and veal. Boneless cuts are almost exclusively low (manufacturing) quality meat used in making hamburgers, hot dogs, and TV dinners. Bone-in meat includes both manufacturing- and table-quality meat. Exports are mostly fresh and frozen beef of manufacturing quality.

Both U.S. and Canadian import duties on fresh and frozen beef and veal are 3 cents a pound for imports from all countries. Canadian tariffs on cured beef imported from the United States are 1 cent a pound on pickled beef products and free on salt beef. Canned beef enters the Canadian market free from Australia and New Zealand and enters over a 20-percent ad valorem duty from non-Commonwealth countries (40).

Table 10.--Canada's exports and re-exports of beef and veal to the United States and other countries, 1960-70

Year	United States 1/			Other 2/ countries--	Total		
	Domestic exports	Re-exports	Total exports	Domestic exports	Domestic exports	Re-exports	Total exports
	Million pounds 3/						
1960	18.0	--	18.0	2.0	20.0	--	20.0
1961	29.0	--	29.0	2.2	31.2	--	31.2
1962	19.7	--	19.7	3.1	21.8	--	21.8
1963	17.2	n.a.	n.a.	2.7	19.9	1.5	21.4
1964	28.5	4/1.3	29.8	5.7	34.2	4/2.0	36.2
1965	72.0	n.a.	n.a.	10.7	82.7	n.a.	n.a.
1966	56.4	4/1.2	57.6	5.8	62.2	4/1.7	63.9
1967	27.4	4/1.8	29.2	4.5	31.9	4/1.9	33.8
1968	47.5	4/1.1	48.6	5.2	53.7	4/1.3	55.0
1969	45.9	4/12.3	58.2	5.0	50.9	4/15.3	66.2
1970	46.8	4/24.8	71.6	3.1	49.9	4/25.5	75.4

-- means zero or less than one-half a unit.
n.a. means not available.

1/ Excludes Puerto Rico.
2/ Mostly Commonwealth America.
3/ Product weight.
4/ Includes some mutton.

Sources: (198; 211; 217).

Domestic exports.--Canadian exports of beef and veal consist mainly of fresh and frozen beef of manufacturing quality, most of it boneless. The United States is the major market. Relatively small, but consistent, quantities are exported to Commonwealth countries and territories in the Caribbean area. There are two major beef and veal export flows to the United States: from eastern Canada to the Northeastern States, and from southern Alberta to the Pacific Northwest.

These relatively large exports of manufacturing beef to the United States occur because of a lower Canadian price level for canners and cutters (low-quality beef animals). This is usually attributed to Canada's relatively larger supply of dairy animals and the lack of official U.S. import quotas.

Canada is now a net importer of manufacturing beef, but the traditional U.S.-Canadian price relationship persists and exports to the United States continue. One reason for this phenomenon is Canada's high level of imports of Oceania beef at prices below those for similar beef on the U.S. market. (In 1972, prices of Oceania beef in Canadian and U.S. markets were equalized (243, Feb. 14, 1972)). These imports assist in keeping the Canadian price down and free supplies of Canadian beef for export to the United States. Canadian packers make money on this operation because they are able to sell Canadian beef on the U.S. market for prices that are higher than the cost of imported Oceania beef, which is substituted on the Canadian market. Canada would not be able to continue exporting substantial quantities of beef to the United States if these exports were not offset by imports from Oceania for the Canadian market.

Re-exports.--During 1968 and 1969, some Oceania beef imports were re-exported to the United States (table 10). In 1970, over a third of Canada's total exports to the

Table 11.--Canada's imports of beef and veal from the United States, Oceania, 1/ and other countries, by class of meat, 1960-70

Class and origin	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970
	Million pounds 2/										
Fresh and frozen:											
Bone-in 3/--											
United States	6.4	5.0	3.7	2.8	4.1	2.5	1.4	1.9	1.2	1.4	1.7
Oceania	10.9	11.2	19.3	21.1	9.6	4.8	1.4	2.1	2.6	7.0	5.7
Others	--	0.2	0.1	0.3	0.1	--	--	--	--	--	--
Total	17.4	16.4	23.1	24.2	13.9	7.3	2.8	4.0	3.8	8.5	7.6
Boneless--											
United States	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	2.9	5.4	2.3	2.9	3.9
Oceania	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	5.4	12.7	14.7	4/97.2	5/122.9
Others	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	--	0.4	--	--	--
Total	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	8.3	18.4	17.1	4/100.1	5/126.8
Canned and cured:											
United States	11.7	12.5	12.4	12.6	12.4	9.9	12.4	15.3	12.9	9.8	9.7
Oceania	3.3	6.4	6.9	6.7	4.4	4.4	3.0	1.3	1.7	2.8	1.8
Others	5.7	5.9	2.9	5.8	5.3	5.5	6.7	11.4	8.2	12.5	11.7
Total	20.7	24.8	22.2	25.0	22.1	19.7	22.1	28.1	22.8	25.1	22.9
Total:											
United States	18.1	17.5	16.1	15.4	16.5	12.4	16.8	22.6	16.5	14.2	15.5
Oceania	14.2	17.6	26.2	27.8	14.0	9.2	9.8	16.2	18.0	4/107.0	5/130.2
Others	5.7	6.1	3.0	6.1	5.4	5.5	6.7	11.8	8.2	12.5	11.7
Total	38.1	41.2	45.3	49.2	36.0	27.1	33.3	50.6	43.8	4/133.7	5/157.4

-- means zero or less than one-half a unit.
n.a. means not available.

1/ Australia and New Zealand.
2/ Product weight.
3/ Includes boneless, 1960-65.
4/ Includes approximately 15.3 million pounds which were subsequently re-exported.
5/ Includes approximately 25.5 million pounds which were subsequently re-exported.

Sources: (198; 212).

United States consisted of Oceania beef. In 1969, approximately 11 percent of Canadian imports of Oceania beef were re-exported to the United States, and in 1970 the proportion reached 19 percent. This trade was halted in June 1970 through a U.S.-Canadian agreement.

Imports.--Canadian beef and veal imports grew rapidly in 1969 and 1970 after having been relatively static during 1960-68 (table 11). Import growth was mainly in boneless beef from Oceania, which by 1970 accounted for the largest share of Canada's import market. The growth of these imports corresponded to the adoption of a beef export diversification program in Australia and the beginning of a period of beef herd expansion in Canada.

U.S. exports to Canada of bone-in fresh and frozen beef and veal consist mostly of prime ribs and strips for the hotel trade in Montreal and Toronto. Boneless beef imports from the United States move into Canadian beef deficit areas.

Canada imports canned and cured beef and veal from the United States (with cured accounting for the majority of such imports); canned corned beef from South America and Australia; and a relatively small amount of other canned beef and veal products, mostly from Europe.

Hogs and Pork

Canada's exports of live hogs are inconsequential, but pork is both exported and imported in substantial quantities. Though most trade is with the United States, a significant amount of trade in pork is carried on with several other countries. In 1970, live hog exports, which were larger than usual, were valued at US$5 million; pork exports amounted to US$35.7 million; and pork imports totaled US$10.3 million.

Live Hogs

Though Canadian live hog exports are relatively insignificant, they have tended to increase (table 12). Most exports are from southern Alberta to the Pacific Northwest of the United States, but a secondary channel runs from Manitoba to the upper Midwestern States. The U.S. import duty on live hogs is 0.5 cent a pound. Canadian exports increased significantly in 1970, primarily because of a shift in relative U.S.-Canadian prices brought about by greatly increased marketings of hogs in western Canada. Canada prohibits the importation of other than purebred hogs from the United States because of the threat of cholera.

Pork

Patterns and trends of trade.--In terms of weight, Canada is usually a net exporter of pork. Total exports were comparatively stable during 1961-70, but imports fluctuated widely from year to year (table 13). The fluctuations are attributable to imports of fresh and frozen pork, which ranged from 17 million to 77 million pounds a year.

The United States is Canada's principal trading partner for all types of pork products. In recent years, Japan has become Canada's second most important export market for fresh and frozen pork. Export markets for cured and canned pork have largely disappeared. The United Kingdom supplied large quantities of fresh and frozen pork imports in 1965 and 1966, and more recently, Ireland has become an important supplier.

Table 12.--Canada's exports of live hogs to the United States 1/ and other countries, 1960-70

Year	U.S.	Other	All countries
	- - - - - - - 1,000 head - - - - - - -		
1960 . .	5.6	1.2	6.8
1961 . .	2.4	2/25.3	27.6
1962 . .	2.7	1.9	4.6
1963 . .	3.2	.5	3.6
1964 . .	2.7	.5	4.2
1965 . .	8.2	.4	8.6
1966 . .	12.0	.7	12.7
1967 . .	19.4	.4	19.8
1968 . .	20.5	.8	21.4
1969 . .	15.8	1.2	17.0
1970 . .	72.8	2/15.5	88.2

1/ Not including Puerto Rico.
2/ Large exports to other countries reflect sales of purebred hogs to Cuba.

Sources: (208; 211; 217).

Trade With the United States.--During the 1960's, Canada's pork exports to the United States averaged 4.7 percent of total Canadian pork output, and imports from the United States ranged from the equivalent of 1.8 to 9.0 percent of Canadian output. 16/ Canada is the only major foreign supplier of fresh pork on the U.S. market but faces heavy competition from Denmark, the Netherlands, and Poland for canned and cured products. Canadian pork now accounts for approximately 19 percent of U.S. pork imports (year ending June 30, 1970) and 1 percent of total U.S. pork consumption (49, p. 172).

Pork products have flowed relatively freely between the United States and Canada since Canadian restrictions on importation of uncooked U.S. pork were lifted in 1960. The two countries' tariffs on pork imports, which are summarized in table 14, take account of all reductions resulting from the Kennedy Round negotiations. Trade in pork between the two countries is based mainly upon: (1) an inelastic demand in the United States for certain high-quality Canadian pork products and (2) a demand for various U.S. pork cuts in Canada based upon the price advantage of these products. This pattern of trade results in stable levels of Canadian exports to the United States, regardless of price differentials, and Canadian imports which tend to vary with price differentials.

The principal pork products exported from Canada to the United States are fresh hams weighing over 16 pounds; Canadian (back) bacon; canned, cured, and boiled hams; pork bellies; and various other fresh pork products. Hams, which account for about three-quarters of fresh pork exports, are sold mainly in the New York City area, where they command as much as 10 cents per pound over U.S. hams. The export of high-quality pork bellies from Alberta to the U.S. Pacific coast is a relatively recent development. Canada imports a wide range of pork products from the United States. Most of this trade moves from the Midwestern States to eastern Canada.

16/ Calculated from (208, tables 47, 65, and 67).

Table 13.--Canada's pork trade with the United States 1/ and other countries, by class of meat, 1960-70

Year	Fresh and frozen			Cured and canned			Total		
	U.S.	Others	All countries	U.S.	Others	All countries	U.S.	Others	All countries
	Million pounds 2/								
Exports:									
1960. . .	35.9	15.2	51.1	8.0	21.0	29.1	43.9	36.3	80.2
1961. . .	34.1	0.9	35.0	8.3	14.9	23.2	42.4	15.8	58.2
1962. . .	35.5	.8	36.3	8.9	14.5	23.4	44.3	15.4	59.7
1963. . .	34.0	.6	34.6	10.5	19.0	29.5	44.5	19.7	64.1
1964. . .	37.1	2.7	39.8	11.3	3.7	15.0	48.4	6.4	54.8
1965. . .	42.2	.9	43.1	11.1	2.7	13.8	53.3	3.6	56.9
1966. . .	37.2	.7	37.9	7.1	2.3	9.4	44.3	3.1	47.3
1967. . .	46.5	2.7	49.2	6.7	2.0	8.7	53.2	4.7	57.9
1968. . .	47.9	3.2	51.1	6.4	1.7	8.0	54.2	4.9	59.1
1969. . .	43.1	5.1	48.2	5.4	1.3	6.7	48.5	6.5	54.9
1970. . .	53.1	9.3	62.4	5.5	1.0	6.5	58.6	10.3	68.9
Imports:									
1960. . .	11.4	--	11.5	5.6	--	5.6	17.0	--	17.1
1961. . .	28.7	--	28.7	12.0	--	12.0	40.6	--	40.7
1962. . .	23.6	0.1	23.6	10.8	--	10.8	34.4	0.1	34.5
1963. . .	75.0	1.9	76.9	11.6	--	11.6	86.6	1.9	88.5
1964. . .	42.1	--	42.2	10.4	--	10.4	52.6	.1	52.6
1965. . .	18.4	9.1	27.5	9.1	--	9.1	27.5	9.1	36.6
1966. . .	18.3	9.1	27.4	9.0	0.1	9.1	27.3	9.2	36.5
1967. . .	17.4	.7	18.0	9.5	.4	9.8	26.8	1.0	27.8
1968. . .	26.6	1.2	27.8	9.8	.7	10.5	36.4	1.9	38.3
1969. . .	55.7	2.3	58.0	11.2	.5	11.7	66.9	2.8	69.7
1970. . .	15.0	2.1	17.1	8.0	.7	8.7	23.0	2.8	25.8

-- means zero or less than one-half a unit.
1/ Exports do not include shipments to Puerto Rico.
2/ Product weight.

Sources: (197; 211; 212).

Table 14.--U.S. and Canadian import tariffs on pork products, as of January 1, 1972

Product	U.S. tariff	Canadian tariff
Pork, fresh and frozen	0.5 cent a lb.	0.5 cent a lb.
Bacon and ham. . . .	2-3 cents a lb.	1.75 cents a lb.
Canned pork and ham.	3 cents a lb.	20-25 percent ad valorem

Source: (40).

III. MAJOR PRODUCTION PATTERNS AND TRENDS

This chapter identifies the major farming areas in Canada that produce the principal grains, beef, and pork. The chapter then examines production trends since 1960.

Physical Setting

Prairie Provinces

Farmlands in the Provinces of Manitoba, Saskatchewan, and Alberta are the most extensive in Canada and account for almost 80 percent of the country's total improved farmland (table 15). All of Canada's rapeseed, over 90 percent of its wheat, barley, and flaxseed, and 60 to 75 percent of its oats are produced in the Prairies. In addition, this region supports half of the nation's cattle population and 40 percent of its hogs.

The farming area of the Canadian Prairie Provinces is located directly north of North Dakota and Montana. Roughly in the shape of a triangle, the region has an 800-mile-long base on the international border and is fringed by the Pre-Cambrian Shield on the northeast, boreal forest on the north, and the Rocky Mountains on the west. At its eastern extremity, the Prairie farming region extends about 100 miles north of the border, but in the west grain is grown as far north as 600 miles above the border (in the Peace River Block).

Climate.--A short growing season and scanty rainfall place severe limitations upon Prairie agriculture. The frost-free season ranges from 115 days in the south to only 80 days in the north (fig. 2). The shorter growing season in the northern regions is partly compensated for by longer days.

Average annual precipitation in the Prairies ranges from 12 to 20 inches (fig. 3). Rainfall is scantiest near the southwestern corner of Saskatchewan and increases rapidly toward the north and east. Rainfall is most abundant during the summer growing season. The aridity of the Prairies adversely affects crop yields and in drought years (such as 1961), average yields can be reduced by as much as half. This same aridity, however, favorably affects the quality of wheat produced.

Table 15.--Agricultural land use in Canada, 1966

Item	Prairie Provinces				Ontario	Other Canada	Total Canada 1/
	Manitoba	Saskatchewan	Alberta	Total			
	Number						
Number of farms 2/. . .	39,747	85,686	69,411	194,844	109,887	125,791	430,522
	1,000 acres						
Total farm area	19,084	65,409	48,983	133,476	17,826	22,823	174,125
Total improved area .	12,446	45,469	27,276	85,199	12,004	10,959	108,154
Crops and fallow. .	11,363	42,914	24,367	78,644	8,589	7,451	94,685
Improved pasture. .	711	1,910	2,311	4,991	2,936	3,015	10,942
Other improved. . .	313	645	599	1,556	479	493	2,527
Woodland.	1,213	1,348	1,859	4,220	2,834	6,929	14,184
Other unimproved area (pasture)	5,425	18,593	19,874	43,865	2,987	4,935	51,787
	Acres						
Average farm size . . .	480	763	706	685	162	181	404

1/ Includes Yukon and Northwest territories.
2/ Farm is defined as a holding of 1 or more acres, with sales of agricultural products in the last 12 months valued at Can$50 or more.

Source: (204).

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Figure 2

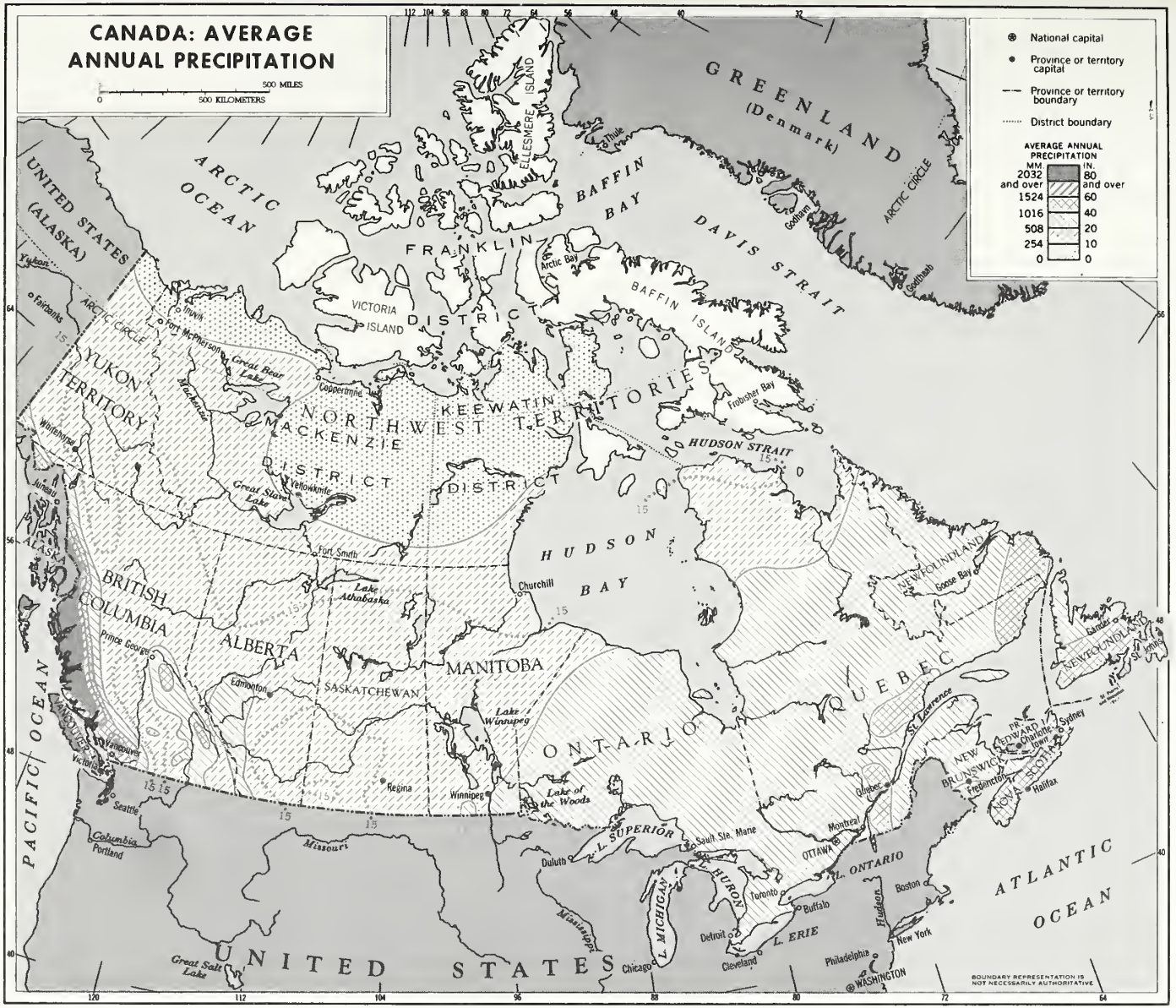

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Figure 3

Vegetation and soils.--The agricultural region of the Prairies can be divided into three zones--prairieland, parkland, and forest--based upon natural vegetation which existed before agriculture was introduced. These zones are closely related to rainfall patterns. The prairieland or grassland zone covers most of southern Alberta and southwestern and southern Saskatchewan. It includes a drier, short-grass region in its south-central section and a tall-grass region surrounding that. The parkland zone forms a band around the prairieland zone. Higher rainfall here led to more abundant vegetation resulting in scattered groves of aspen and oak which gave the area a park-like appearance. The parkland is a transitional area between the prairie grasslands and the forest zone, which extends northward to the Arctic tundra. The outer limits of the Prairie Provinces' farming area is contained within the southern fringes of the forest zone.

The Prairies can also be divided into four principal soil zones which are closely related to the natural vegetation zones. (The boundaries of the various zones are shown in fig. 4 but are not as precise as indicated.)

The brown soil zone corresponds closely to the short-grass part of the prairieland zone and includes the most arid parts of Saskatchewan and Alberta. The soils are generally shallow with relatively small amounts of organic matter. The principal enterprise in the area is wheat production, but extensive cattle grazing is important over much of the unimproved land in areas where soils or rainfall will not support wheat production. Wheat yields in this region fluctuate greatly, and even in good years they average lower than those in the other soil zones.

The dark brown soil zone occupies a band 50 to 100 miles wide surrounding the brown soil zone and is roughly analogous to the tall-grass part of the prairie zone. The soils are deeper and more fertile than in the brown soil zone. This region is heavily dependent upon wheat production and consistently produces the country's best quality wheat.

The black soil zone (including the gray-black or degraded black zone) stretches across all three Prairie Provinces and more or less corresponds to the parkland zone. Its deep, rich soils are considered to be the most fertile in Canada. Grain yields here are higher and less variable than in the other soil zones, but wheat quality is generally lower and the heavier soils require more numerous tilling operations, which raises production costs. Because of higher rainfall and more fertile soils, a more diversified pattern of farming has developed in this region than in the drier soil zones.

A zone of gray-wooded soils borders the forest fringe of the Prairie Provinces. These soils are low in natural fertility and require fertilizers and special crop rotations. This zone is not conducive to quality-wheat production, in part because of the short growing season. Most farmers produce feed and raise livestock.

The high lime soil zone around Lake Manitoba is of minor agricultural importance. The farmlands of the Peace River Block in northwestern Alberta (they also extend into British Columbia) include a large proportion of degraded black soils (4; 43; 48; 54).

Ontario

In 1966, Ontario's 12 million acres of improved land, more than two-thirds of which was in crops, accounted for 11 percent of Canada's improved land. Because of the variety of soil and climatic conditions, cropping patterns of Ontario show a great deal of variation. The Province has over 35 percent of Canada's commercial dairy

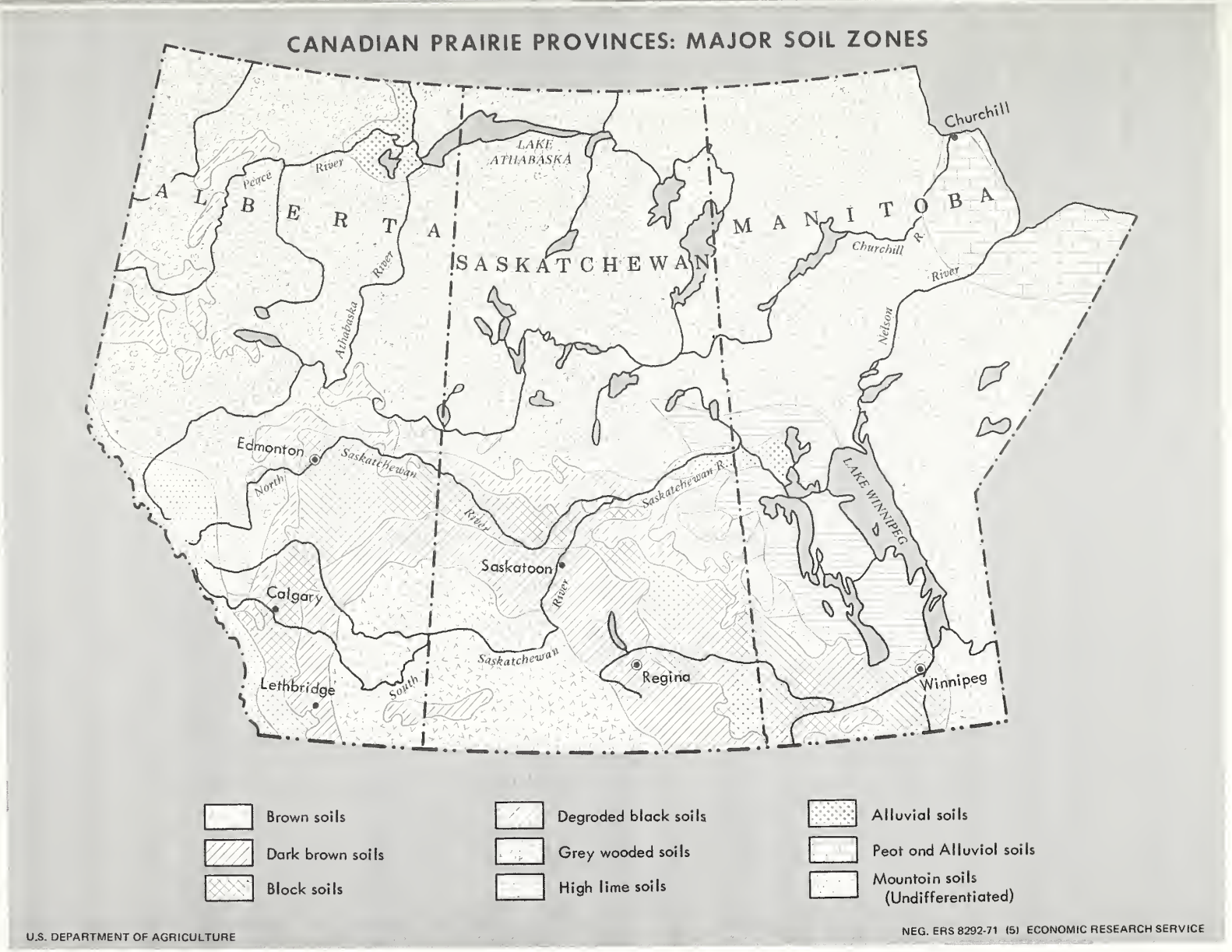
CANADIAN PRAIRIE PROVINCES: MAJOR SOIL ZONES
ALBERTA
SASKATCHEWAN
MANITOBA
LAKE ATHABASKA
Peace River
Athabaska River
Churchill
Churchill R.
River
Nelson River
LAKE WINNIPEG
Saskatchewan R.
North Saskatchewan River
South Saskatchewan River
Edmonton
Saskatoon
Calgary
Lethbridge
Regina
Winnipeg
Brown soils
Dark brown soils
Block soils
Degroded black soils
Grey wooded soils
High lime soils
Alluvial soils
Peot ond Alluviol soils
Mountoin soils (Undifferentiated)
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Figure 4

farms and more than 40 percent of the commercial livestock farms. 17/ Ontario farmers grow almost all of the Canadian grain corn crop. Other important crops are tobacco, soybeans, small grains, and fruits and vegetables.

Most agricultural activity in Ontario is centered in the lower peninsula (the area bounded by Lakes Huron, Erie, and Ontario) and the area north of the St. Lawrence River. Cash corn and soybean production is centered in the southwestern counties (directly east of Detroit, Mich.). The agriculture of central Ontario (area north of Lake Ontario) is based on mixed farming with heavy emphasis on livestock production. Livestock production predominates in the counties south of Georgian Bay and west of Lake Huron (western Ontario).

Climatic features of Ontario include the influence of the large bodies of water that nearly surround the agricultural areas of the Province. Southwestern Ontario has the longest frost-free period, 200 days, but it also is the driest area in eastern Canada, with an average annual precipitation of approximately 30 inches. There is seldom a year without a drought period, so many farms have supplemental irrigation systems. Heavier rainfall and a shorter growing season are found as one proceeds northeast. At the limits of the agricultural area, rainfall is approximately 45 inches annually and the frost-free period is as short as 100 days.

The soils of southern Ontario are predominantly gray-brown podzols which developed under deciduous hardwood cover. Agricultural lands near Lake Erie, Lake Ontario, and the St. Lawrence River are very flat, while outside that area they tend to be rolling (4; 43; 48; 144).

Other Canada

The most important farming area in the residual region of Other Canada is Quebec, which in 1966 accounted for 64 percent of the farms and 70 percent of the improved agricultural land in Other Canada. The principal agricultural activities in Quebec are dairy farming and hog production, which are centered along the St. Lawrence River Valley between Montreal and Quebec City. Climate is moderated by the water expanses of the river. The frost-free period varies from 145 days near Montreal to 105 days along the Gaspé shoreline. At any distance from the river, the frost-free period is shorter. Soils are generally gray podzols.

In 1966, the four Atlantic Provinces accounted for 16 percent of the improved farmland in Other Canada. The main types of operations are dairying, hog raising, and potato farming. Production is scattered through various areas in Prince Edward Island, New Brunswick, and Nova Scotia. There is almost no agricultural activity in Newfoundland.

In 1966, 15 percent of the improved farmland in Other Canada was in British Columbia. The main types of activities are dairying, cow-calf operations, and fruit and vegetable raising. Aside from the Peace River District, which is usually considered as part of the Prairie region, agriculture in British Columbia is concentrated in the Frazer River Valley east of Vancouver and in various interior valleys in the central and eastern portions of the Province (4; 43; 48).

17/ A commercial farm in Canada is one with sales of at least Can$2,500 while in the United States, use of the term is restricted to farms with sales of more than US$10,000.

Production Trends

During 1956-66, which is the period covered by the two most recent Canadian censuses of agriculture, the improved area in farms expanded nearly 8 million acres. These came from a 9.5 million-acre increase in the Prairie Provinces and a 1.5 million-acre decrease in the rest of Canada. Saskatchewan, the principal wheat-producing region, had the largest increase over the period.

As can be seen in table 16, the 1960's saw large increases in the acreage of barley, wheat, corn, and other crops and decreases in oats acreage. 18/ Various indicators show that the beef cattle industry grew rapidly, while the dairy industry declined in relative importance. Hog production fluctuated considerably throughout the decade, but tended to increase. A commodity-by-commodity discussion of production trends in the 1960's follows. (App. tables 1 and 2 provide more detail.)

Wheat

Wheat has always been the dominant crop in the Prairies (fig. 5), but its relative importance has declined somewhat in recent years. In 1964, it accounted for about 60 percent of the acreage sown to crops in the region, but was down to 48 percent in 1969. Wheat production in the Prairie Provinces averaged 589 million bushels a year through the 1960's (97 percent of total Canadian production), ranging from an all-time high of 807 million bushels in 1966 to a low of 260 million bushels in the drought year of 1961. Through the last decade, 64 percent of all Prairie wheat was grown in Saskatchewan, 24 percent in Alberta, and 12 percent in Manitoba.

Practically all of the wheat grown in the Prairie Provinces is spring wheat, and most of it is high-quality, hard, bread wheat. A large amount of Durum wheat is also grown. Durum wheat production ranged from 15 million to 83 million bushels during the 1960's and averaged 37 million bushels a year. The amount of lower quality and feed wheats produced depends mainly upon growing conditions. During 1962-66, 20 percent of inspected Prairie wheat was graded below No. 4 Northern.

Production trends for wheat and other important commodities are summarized in table 16 and illustrated in figure 6. Under a wheat stock reduction program (LIFT), 1970 wheat acreage fell 50 percent below 1969 acreage. 19/ Consequently, 1970 data were excluded in calculating acreage trends. During 1960-69, overall wheat acreage in Canada increased at the rate of 325,000 acres a year.

Wheat acreage in the Prairie Provinces increased at the annual rate of 1.2 percent during 1960-69. Fastest growth was in Saskatchewan and the slowest in Manitoba. Variation in yearly wheat acreage for all three Prairie Provinces was so large that not one of the trend estimates was statistically significant. 20/

18/ The other crops category is mostly rapeseed, flaxseed, and rye.

19/ Lower Inventory for Tomorrow (LIFT), described in ch. 4.

20/ Statistical significance indicates the degree of confidence one can have in the estimated trend line. If the annual observations lie on or very near the calculated trend line, one can place more confidence in the line than if the observations are randomly scattered on either side of the line. In this report, a trend estimate is said to be statistically significant if one can be at least 95 percent confident that a trend exists. Use of a lower level of confidence would have categorized more trend estimates as statistically significant. To facilitate consistent comparisons, non-significant trend estimates are shown and discussed.

Table 16.--Annual rates of change in selected measures of agricultural production, Canada, 1960-70 1/

Item	Prairie Provinces								Ontario		Other Canada		Total Canada	
	Manitoba		Saskatchewan		Alberta		Total							
	1,000 acres	Percent	1,000 acres	Percent	1,000 acres	Percent	1,000 acres	Percent	1,000 acres	Percent	1,000 acres	Percent	1,000 acres	Percent
Acreage and percentage changes in:														
Wheat 2/. . .	20	0.6	260	1.4	58	1.0	339	1.2	*-23	-5.3	9	6.1	325	1.2
Barley 3/ . .	53	6.8	72	3.5	*226	6.3	*351	5.5	*32	4/	*16	10.9	*399	5.9
Barley 5/ . .	*71	9.0	*109	5.2	*215	6.0	*395	6.1	*31	4/	*14	9.5	*440	6.5
Oats.	-10	-0.6	-38	-1.9	*-50	-2.3	-99	-1.7	*-115	-8.7	-49	-3.6	*-263	-3.1
Grain corn. .	6/	6/	6/	6/	6/	6/	6/	6/	*69	11.3	*7	4/	*76	12.1
Fodder corn .	-1	-3.6	--	11.6	6/	6/	-1	-2.1	*33	8.8	*6	8.7	*38	7.9
Tame hay. . .	8	0.8	*35	3.1	*81	3.0	*124	2.6	-19	-0.6	-8	-0.2	*98	0.8
Total forage.	7	0.7	*33	2.8	*81	3.0	*123	2.5	14	0.4	-2	-0.1	*135	1.0
Other 7/. . .	*76	5.7	49	3.0	*69	4.8	194	3.3	*26	2.3	1	0.6	*222	3.8
Other 8/. . .	*91	6.8	160	9.3	*124	8.5	*375	8.3	*27	2.4	1	0.3	*403	6.9
	1,000 head	Percent	1,000 head	Percent	1,000 head	Percent	1,000 head	Percent	1,000 head	Percent	1,000 head	Percent	1,000 head	Percent
Number and percentage changes in: 9/														
Total cattle.	7	0.6	13	0.7	*76	2.6	*95	1.6	9	0.7	-2	-0.1	*101	0.9
Nondairy cattle	15	1.8	28	1.6	*86	3.3	*129	2.5	19	0.8	1	0.5	*149	1.7
Beef cows . .	*12	4.2	*24	3.3	*28	3.0	*65	3.3	*6	1.8	8	2.3	*78	3.0
Steers. . . .	1	1.3	--	0.3	*18	6.2	*19	3.7	10	1.9	1	1.2	*31	2.6
Hogs.	*37	7.8	18	2.3	3	0.2	57	2.5	42	2.2	*41	3.2	*140	2.5
Cattle marketings .	*11	3.6	16	2.8	*57	5.5	*84	4.4	*29	3.2	-4	1.6	*117	3.8
Calf marketings .	6	4.8	*13	6.0	5	2.4	*24	4.3	1	0.4	*16	4.3	*41	3.5
Hog marketings	*37	6.3	2	0.4	-20	-1.3	18	0.7	*43	1.6	*104	5.8	*165	2.3

* Significant at the 5-percent level.
-- means zero or less than one-half a unit.

1/ Annual rates of change were estimated by linear trend analysis. The physical change is the trend coefficient, while the percentage change is the annual rate of change between the lower and upper trend values. 2/ 1960-69 data are used for wheat because the 1970 wheat program caused large acreage decreases in the major wheat-producing regions. 3/ 1960-69 data are used for barley because the 1970 wheat program caused major changes in barley acreage. 4/ Over 15 percent annual rate of change. 5/ Barley trend calculated for 1960-70 for comparative purposes. 6/ Insignificant level of production. 7/ Includes rye, mixed grains, buckwheat, rapeseed, flaxseed, mustard seed, sunflowerseed, and soybeans. Data calculated for 1960-69 to exclude effects of 1970 wheat program. 8/ Calculated for 1960-70 for comparative purposes. 9/ All livestock trends are based on 1960-69.

Source: Authors' calculations from data in (198; 208; 216).

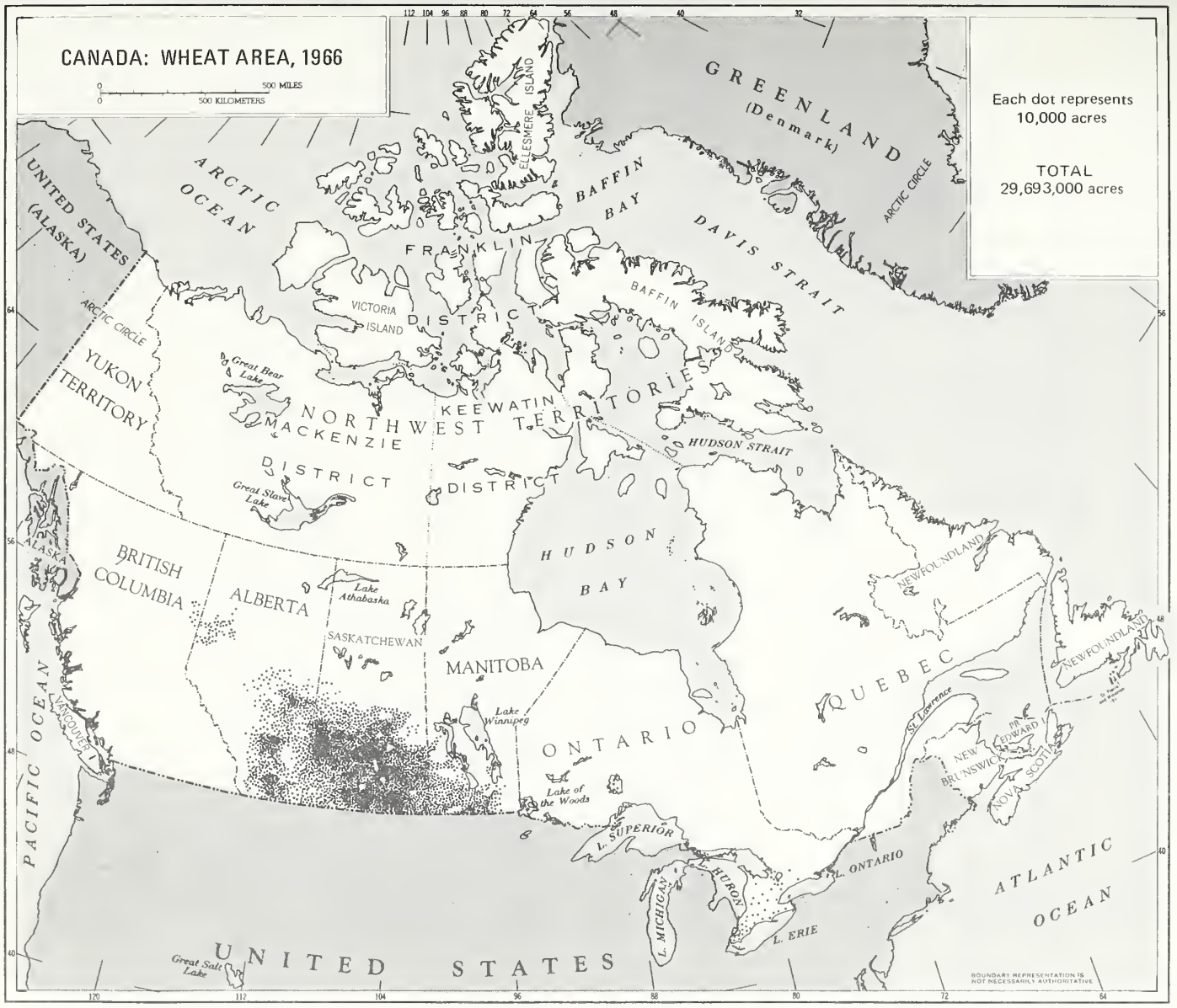

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Figure 5

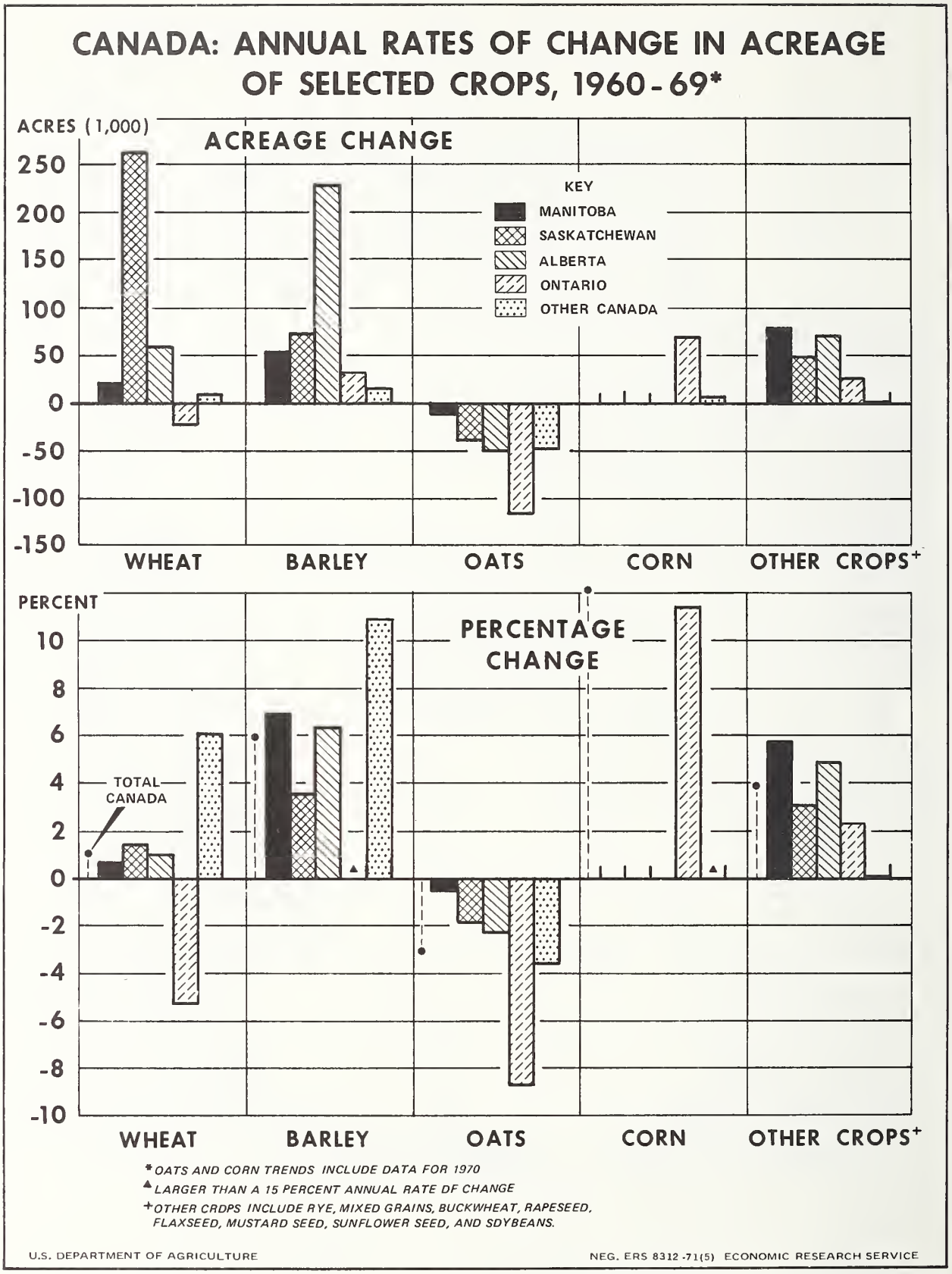
CANADA: ANNUAL RATES OF CHANGE IN ACREAGE OF SELECTED CROPS, 1960-69*
ACRES (1,000)
ACREAGE CHANGE
250
200
150
100
50
0
-50
-100
-150
KEY
MANITOBA
SASKATCHEWAN
ALBERTA
ONTARIO
OTHER CANADA
WHEAT
BARLEY
OATS
CORN
OTHER CROPS+
PERCENT
PERCENTAGE CHANGE
10
8
6
4
2
0
-2
-4
-6
-8
-10
TOTAL CANADA
WHEAT
BARLEY
OATS
CORN
OTHER CROPS+
*OATS AND CORN TRENDS INCLUDE DATA FOR 1970
▲LARGER THAN A 15 PERCENT ANNUAL RATE OF CHANGE
+OTHER CROPS INCLUDE RYE, MIXED GRAINS, BUCKWHEAT, RAPESEED, FLAXSEED, MUSTARD SEED, SUNFLOWER SEED, AND SOYBEANS.
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Figure 6

Barley

In the Prairie Provinces, barley is one of the principal alternatives to wheat production (fig. 7). Canadian barley production averaged 233 million bushels a year during the 1960's and increased to 416 million bushels in 1970. Well over 90 percent of this production was in the Prairies. Prairie barley acreage, which ranged from 5 million to 9.5 million acres during 1960-70, accounted for 19 percent of the region's total crop acreage in 1969--up from 15 percent in 1960. Over half of the Prairie barley crop is harvested in Alberta.

For all of Canada, barley acreage increased approximately 5.9 percent annually during 1960-69. This represents 400,000 acres a year or production of 15 million bushels with average yields. Barley acreage increase was greatest in Alberta. Ontario barley acreage rose rapidly during 1960-70; however, the rapid rate of increase, over 15 percent annually, is mostly a reflection of the small base rather than of large annual increments.

Oats

Canadian production of oats fell from 493 million bushels in 1962 to 268 million bushels in 1970. The Prairie Provinces account for approximately three-quarters of total production (fig. 8). Prairie oats acreage in 1969 was equal to 11 percent of total crop acreage for the region.

Production of oats declined an estimated 3.1 percent a year throughout 1960-70. This decline represents 263,000 acres which, with average yields, would produce 12 million bushels of oats. All regions shared in the decline, though at different rates. The largest rate of decline was estimated to be 8.7 percent in Ontario and the smallest was 0.6 percent in Manitoba. The acreage decline was greatest in Alberta and Saskatchewan. The 1970 wheat program (LIFT) did not induce a significant increase in oats area; in fact, only in Alberta was 1970 oats acreage larger than the 1969 acreage.

In most parts of Canada, oats and barley are substitute feed crops, and a cursory comparison of rates of change for oats and barley seems to indicate that barley is replacing oats. However, comparing acreage trends on a regional basis shows this is only a partial explanation of barley acreage increases. For example, in the Prairie Provinces, oats have trended downward at a rate of 100,000 acres a year, while at the same time the barley trend has been upward at a rate of 400,000 acres a year.

Corn

During 1960-70, Canadian grain corn acreage, practically all of it in Ontario, grew from less than 500,000 acres to 1.2 million acres (fig. 9). Production almost quadrupled, increasing from 26 million to 100 million bushels. The growth of Ontario corn and barley acreage during the 1960's was mainly at the expense of oats and winter wheat. Acreage in other crops, mainly soybeans and mixed grains (see below), increased at a more moderate rate.

Grain corn production in Quebec grew from a negligible amount in the early 1960's to 6.7 million bushels in 1970.

Other Crops 21/

A major alternative land use in the Prairie Provinces is production of oilseed crops. Oilseed crops make up most of the "other crops" category shown in table 16.

21/ Includes rye, mixed grains, buckwheat, rapeseed, flaxseed, mustard seed, sunflower seed, and soybeans.

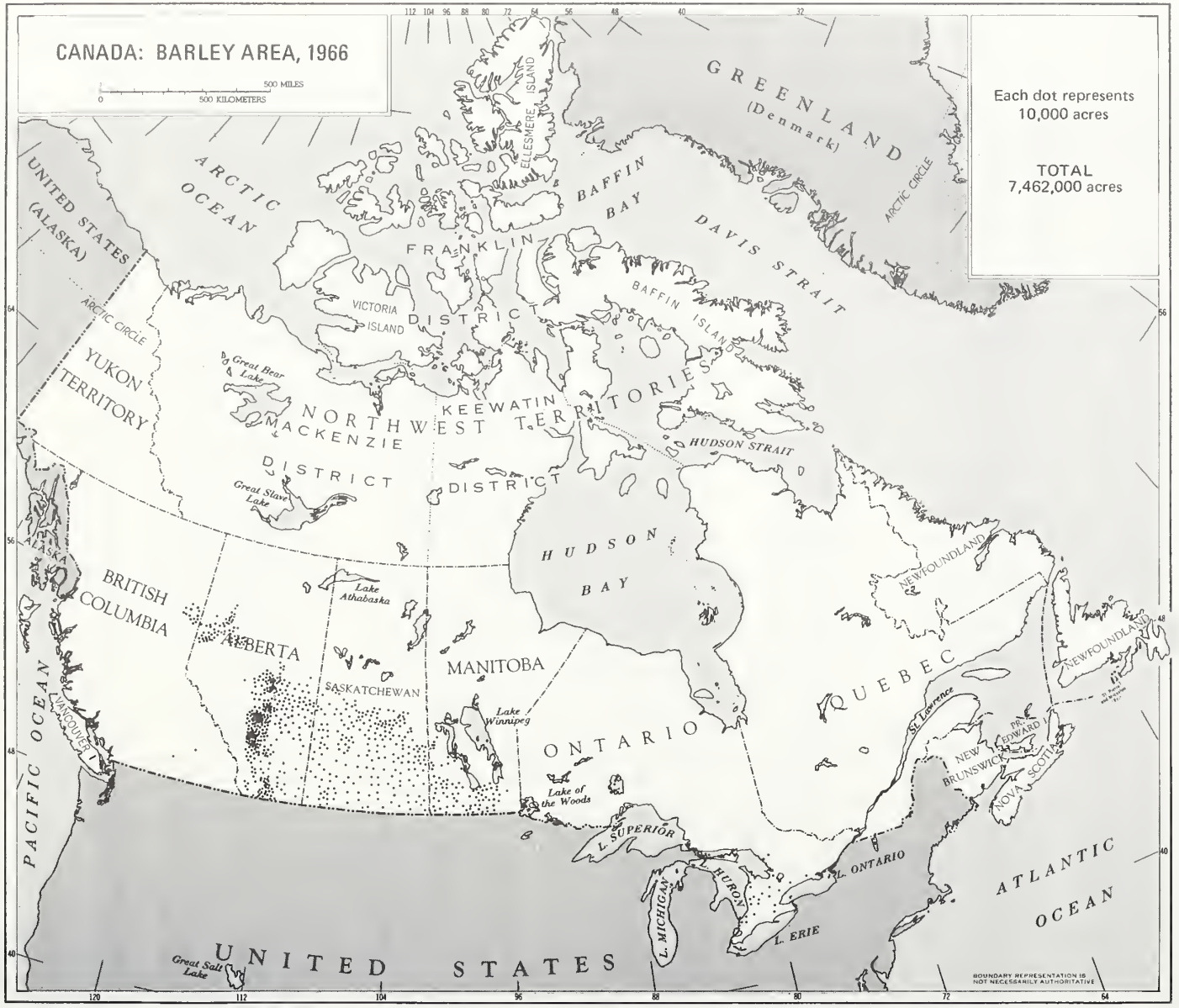

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Figure 7

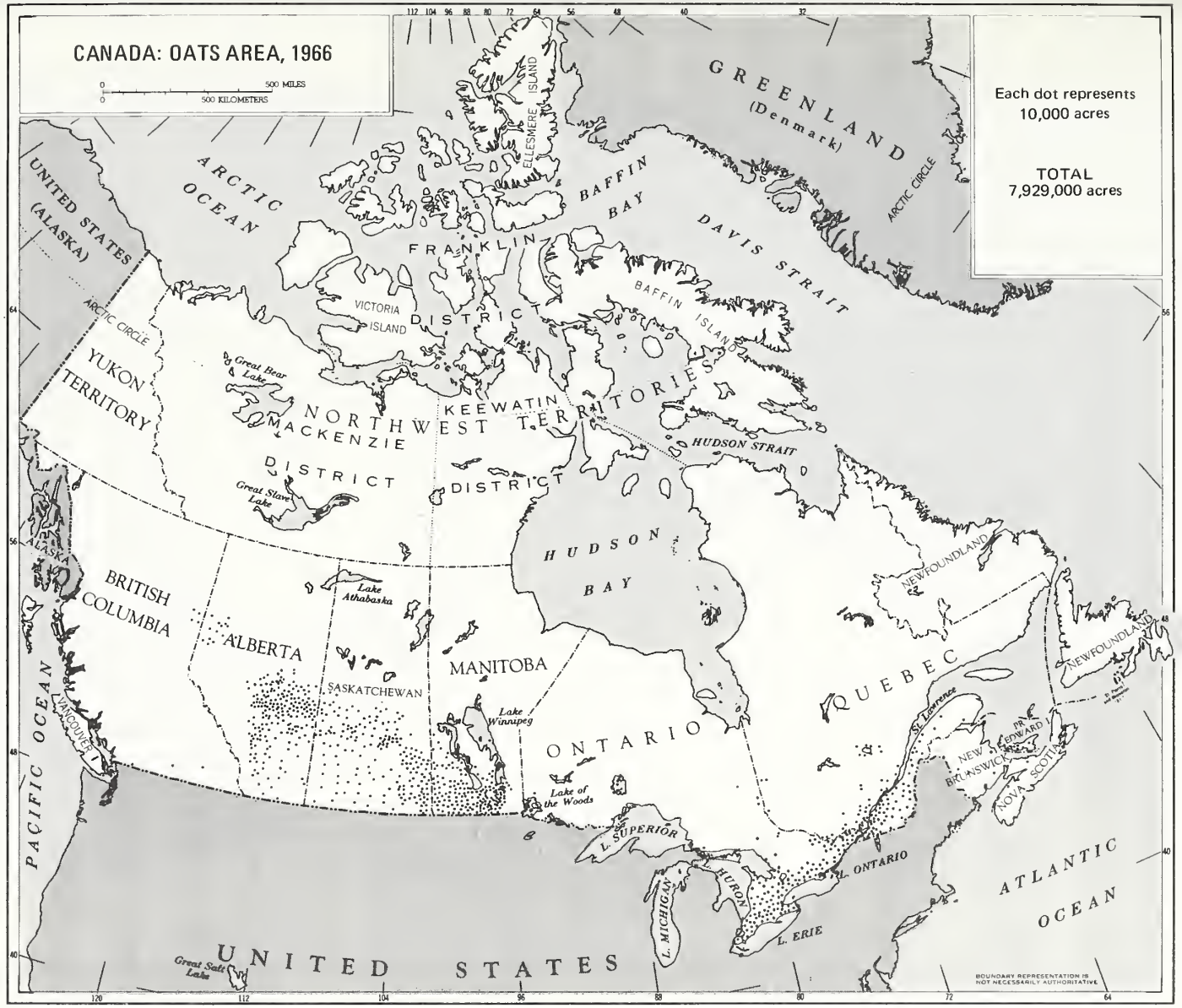

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Figure 8

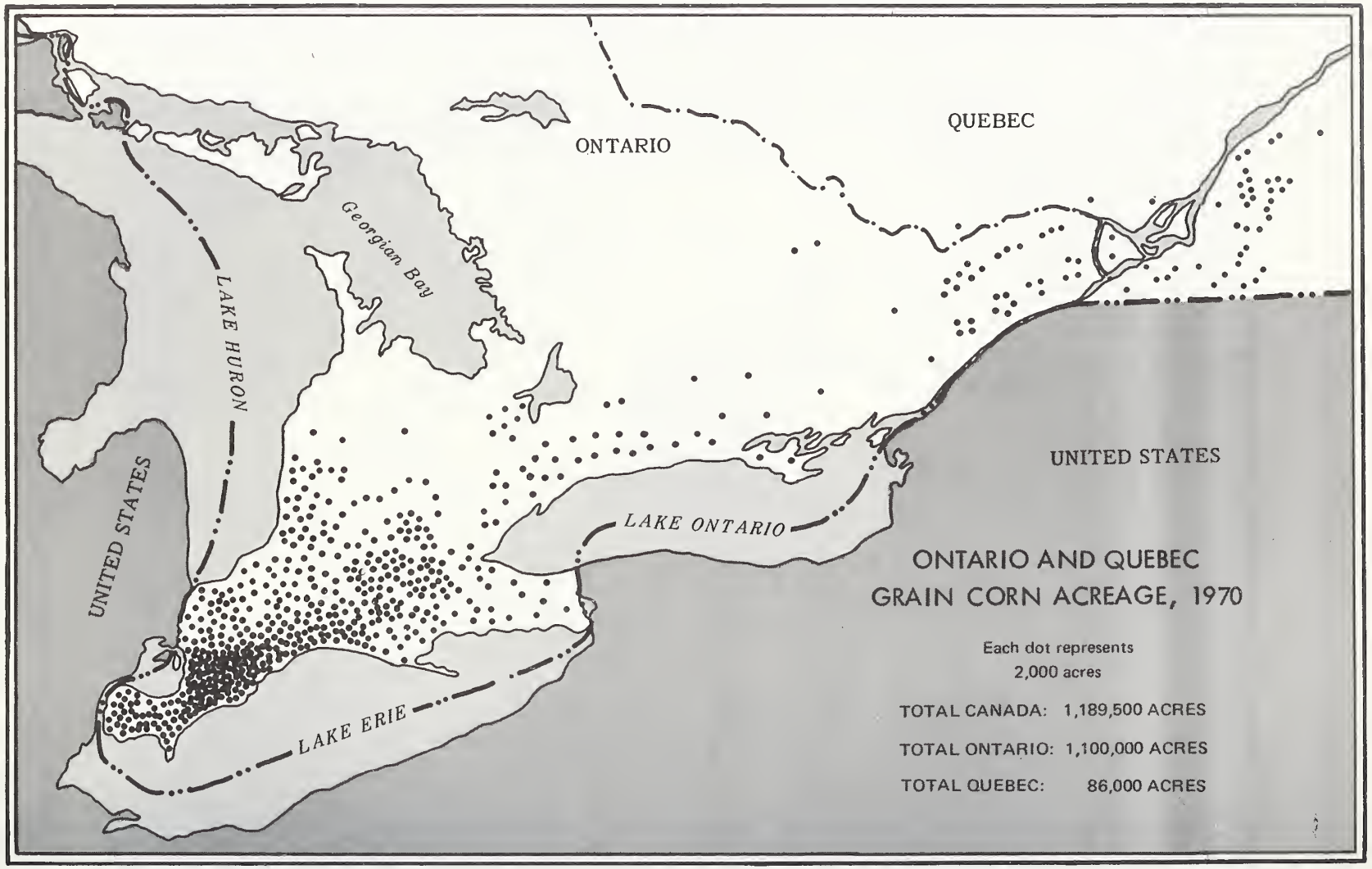

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Figure 9

Flaxseed and rapeseed are the principal oilseed crops of the Prairie Provinces. In 1970, these two crops accounted for 17 percent of land sown to crops in the Prairies--a tremendous increase over the 1960-69 average of 6 percent. The increase was principally due to the sowing of oilseeds as an alternative to wheat in a time of surplus wheat supplies. Oilseed production in the Prairies, particularly rapeseed, is concentrated in the cooler, more humid black soil zone. During the 1960's, Manitoba was the principal flaxseed producer with 46 percent of Prairie production, followed by Saskatchewan and Alberta with 32 and 22 percent, respectively. Rapeseed production is concentrated farther west in Saskatchewan, which accounted for 50 percent of production during the 1960's and in Alberta, which accounted for 41 percent.

In eastern Canada, soybean production is an important alternative to corn production, particularly in the warmer areas. At present, soybean production is confined largely to Ontario's five southwestern counties, where yields are comparable to those in the Corn Belt of the United States.

Rye, another alternative crop, is grown in all agricultural regions but is concentrated in the Prairie Provinces. Rye acreage in Canada trended upward during 1960-70, with the largest increase occurring in Saskatchewan.

The acreage in all alternative crops increased an average of 3.8 percent annually during 1960-69 (table 16). The rate of increase becomes much more rapid if 1970 is included in the period. Among the regions, the growth rate was most rapid in Manitoba and Alberta. Rapeseed accounts for the greatest part of this growth.

Roughage Crops

Forage.--Two principal forage crops, fodder corn and tame hay, were used to estimate trends in regional production of forage crops. Tame hay accounts for 95 percent of total area in the two crops and is cultivated throughout the country. The main fodder corn regions, Ontario and Quebec, are the same as those of grain corn.

The most significant upward trend in forage acreage occurred in Alberta, where acreage increased at an average annual rate of 3.0 percent. Ontario had relatively large increases in fodder corn acreage, but these were offset by decreases in area used for tame hay production. For all of Canada, acreage devoted to these two forage crops rose approximately 1 percent a year during the 1960's. However, acreage may not be a good proxy for production since the decrease in tame hay in eastern Canada was offset by an increase in fodder corn area and the two have very different yields per acre.

Grazing land.--The Canadian census of agriculture, which is taken every 5 years, is the only readily available source of pastureland area estimates. The census reports two categories of pasture--improved pasture and other, unimproved area (excluding woodland). The 1966 census reported 11 million acres of improved pasture and 52 million acres of unimproved pasture. The Prairie Provinces accounted for 46 percent of the improved pasture and 84 percent of the unimproved pasture (table 15). During 1956-66, area in unimproved pasture dropped slightly in the Prairie Provinces, with 500,000-acre increases in Manitoba and Alberta being more than offset by a 1.4 million-acre decrease in Saskatchewan. On the other hand, improved pasture showed a 2 million-acre increase in the Prairie Provinces--up two-thirds during the 10-year period, which represents an annual growth rate of 5.2 percent. In Ontario and Other Canada, both pasture categories declined, probably reflecting the drop in total farm area in both regions.

Beef Cattle

There are various ways of measuring beef production and beef production capacity. Total cattle numbers and nondairy cattle numbers (all cattle except dairy cows; that is, beef breeds plus dairy breed heifers, steers, and calves) give an idea of the size of the whole herd. Beef cow numbers, however, are a better indicator of beef production capacity and are a measure of the size of cow-calf operations. The number of steers on farms on December 1 is a good proxy for the number of beef animals on feed. Annual cattle marketings and calf marketings are measures, respectively, of the number of cattle sold for slaughter and the number of cattle going on feed. Cattle and calf marketings also indicate to some extent the growth of stocker cattle operations (operations marketing yearling calves) and the sales of dairy calves for veal. Appendix tables 3 and 4 present data on all the above for Canada, by region, for 1960-70. The distribution of nondairy cattle numbers is shown in figure 10.

Canada's total livestock population grew from 10.7 million in 1960 to 12.2 million in 1970. The nondairy cattle population increased by 2 million in 1970 to a total of 9.7 million. Cattle numbers decreased from the previous years' totals in 1965, 1966, and 1968, indicating a period of herd depletion.

A little over one-half of all cattle and 60 percent of nondairy cattle are located in the Prairie Provinces. In 1970, Alberta alone accounted for 27 percent of Canada's total cattle population and Ontario accounted for 26 percent. Total numbers of beef cows on farms increased from 2.2 million to 3.1 million between 1960 and 1970. In the latter year, Alberta and Saskatchewan were the leading Provinces with 37 and 28 percent, respectively, of total numbers. In 1970, 43 percent of Canada's 1.2 million steer population was located in Ontario and 26 percent in Alberta.

Total Canadian cattle marketings grew from 2.5 million to 3.6 million between 1960 and 1965. A herd rebuilding process kept marketings down to 3.2 million in 1970. Calf marketings, which numbered 1.2 million in 1970, followed the same growth patterns as cattle marketings.

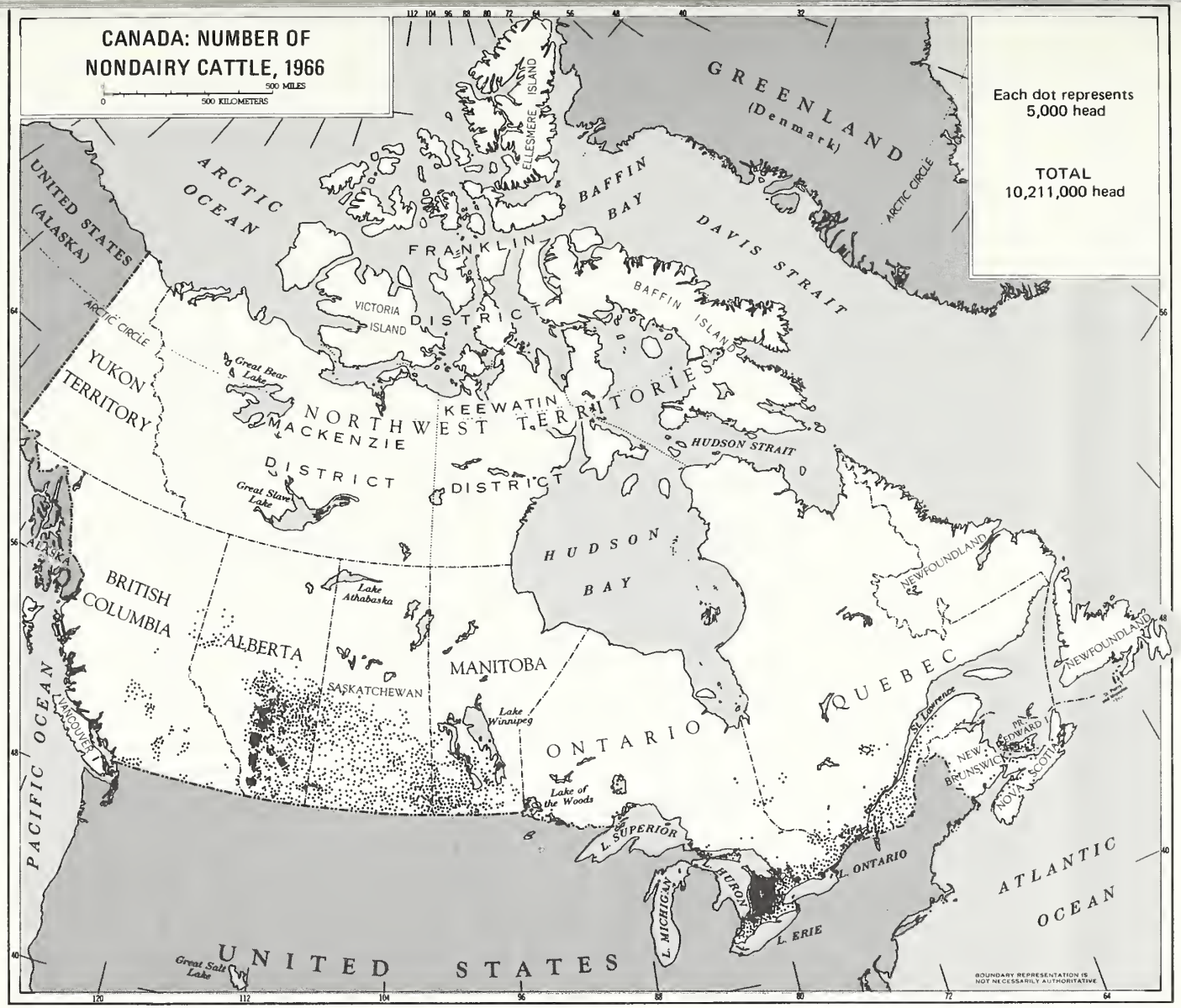
Growth trends of livestock indicators during 1960-69 are shown in table 16 and figure 11. Trends are based on 1960-69 data because December 1, 1970, estimates were not available when the data were computed. Total cattle numbers increased at a rate of 0.9 percent or 101,000 head a year. Practically all of this growth was in the Prairie Provinces, particularly in Alberta. The percentage growth rate for nondairy cattle--1.7 percent--was almost twice as rapid.

The importance of cow-calf operations, as indicated by changes in beef cow numbers and calf marketings, increased most rapidly in the Prairie Provinces, particularly Saskatchewan and Manitoba. These two Provinces also registered large increases in cattle marketings, which in their particular cases, are signs of growth in stocker cattle operations. Growth rates for total Canada were 3 percent for beef cow numbers and 3.5 percent for calf marketings. There was little increase in cow-calf operations in Ontario, and most of the increase in Other Canada calf marketings was due to growth in dairy calf marketings.

Growth in cattle-feeding operations, measured by changes in steer numbers and cattle marketings, was by far the greatest in Alberta. Ontario cattle feeding also grew substantially. The feedlot industry in Alberta grew much more rapidly than did any other livestock industry in the Province.

Hogs

Development of the Canadian pork industry during 1960-70 is shown in appendix tables 3 and 4. Regional distribution of the hog population is shown in figure 12.



U.S. DEPARTMENT OF AGRICULTURE NEG. ERS 8289-71 (5) ECONOMIC RESEARCH SERVICE

Figure 10

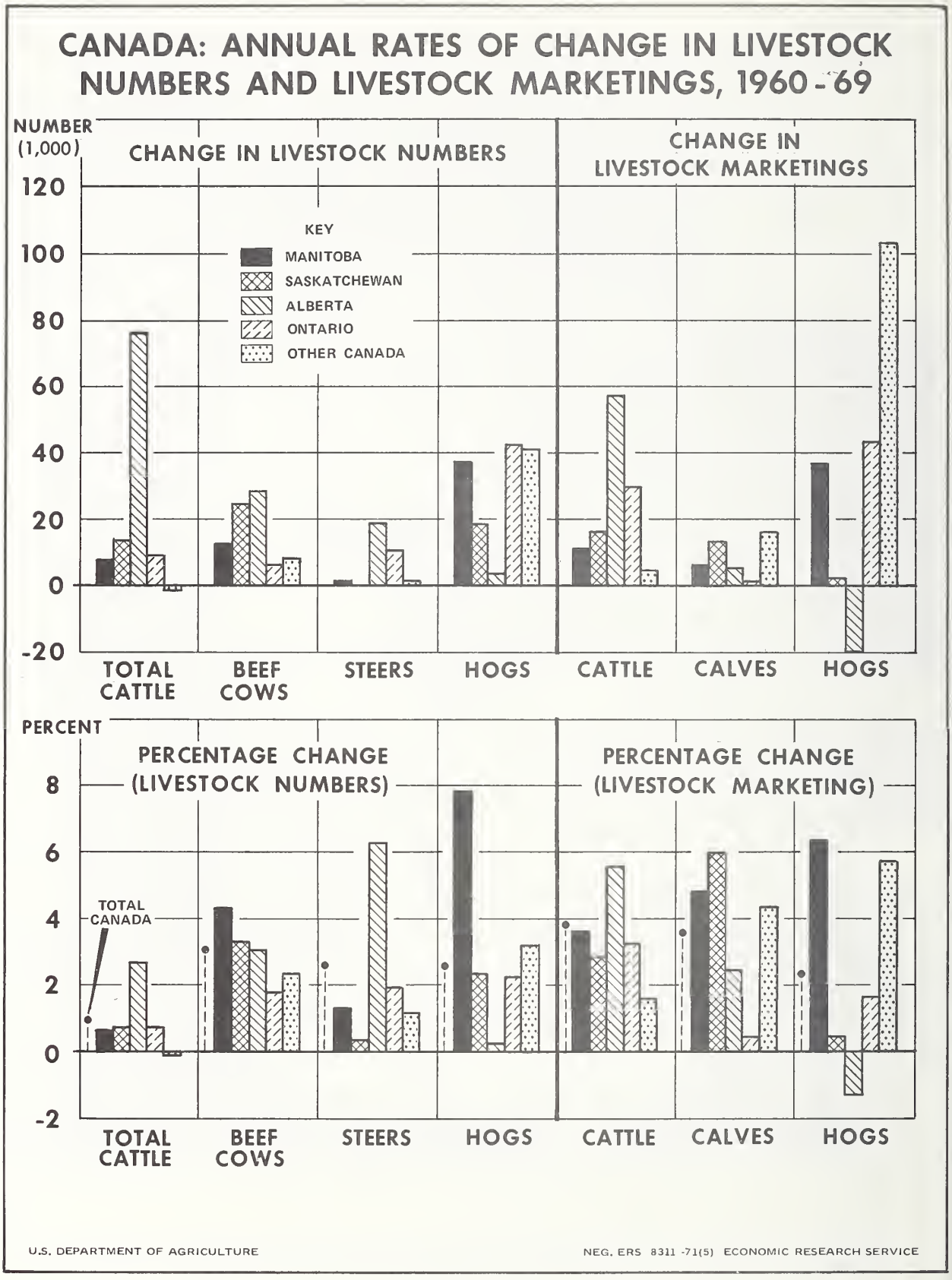

CANADA: ANNUAL RATES OF CHANGE IN LIVESTOCK NUMBERS AND LIVESTOCK MARKETINGS, 1960-69
NUMBER (1,000)
CHANGE IN LIVESTOCK NUMBERS
CHANGE IN LIVESTOCK MARKETINGS
KEY
MANITOBA
SASKATCHEWAN
ALBERTA
ONTARIO
OTHER CANADA
120
100
80
60
40
20
0
-20
TOTAL CATTLE
BEEF COWS
STEERS
HOGS
CATTLE
CALVES
HOGS
PERCENT
PERCENTAGE CHANGE (LIVESTOCK NUMBERS)
PERCENTAGE CHANGE (LIVESTOCK MARKETING)
TOTAL CANADA
8
6
4
2
0
-2
TOTAL CATTLE
BEEF COWS
STEERS
HOGS
CATTLE
CALVES
HOGS
U.S. DEPARTMENT OF AGRICULTURE
NEG. ERS 8311-71(5) ECONOMIC RESEARCH SERVICE

Figure 11

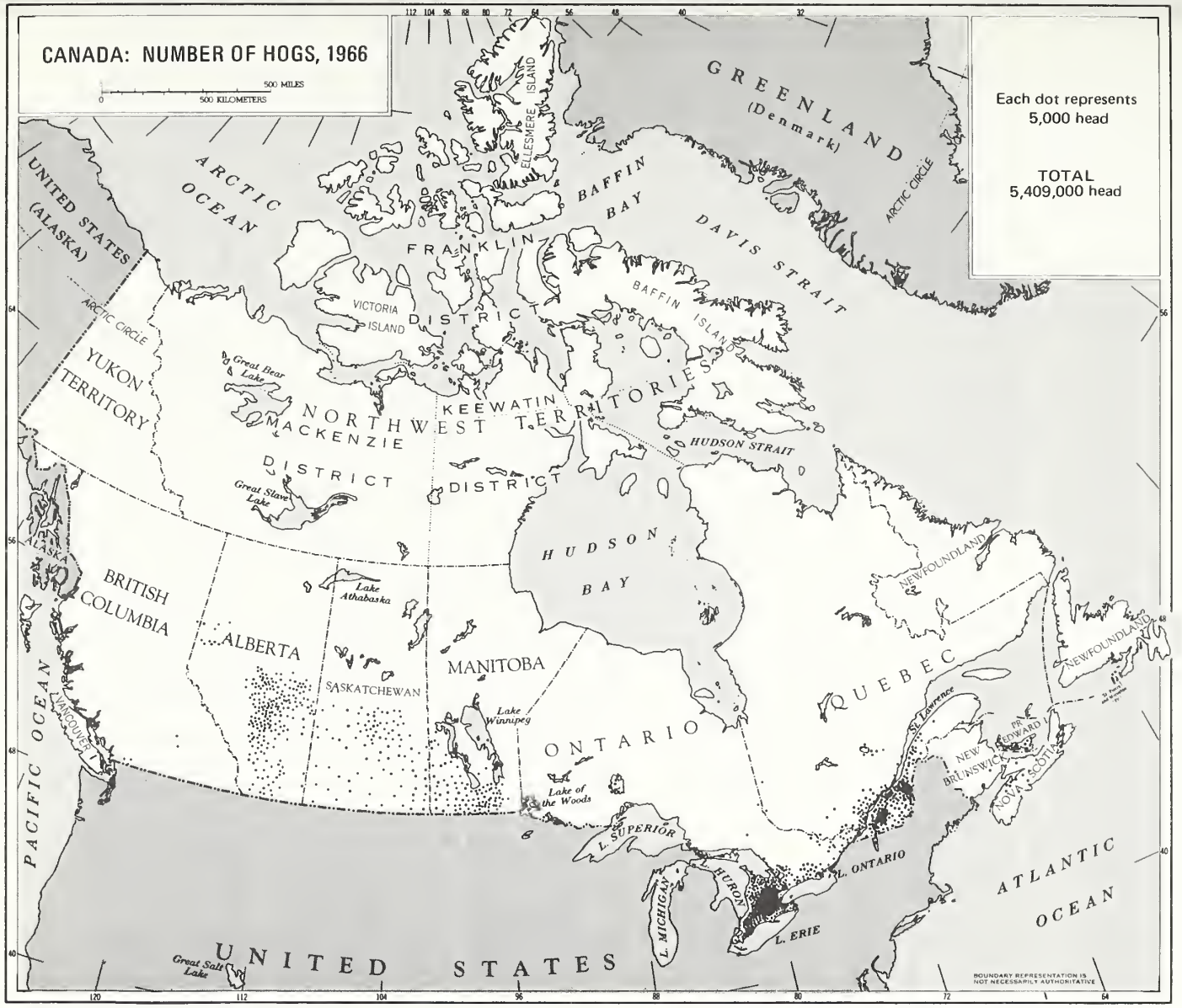


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Figure 12

Total Canadian hog numbers fluctuated from year to year during 1960-68, ranging from 5.0 million in 1962 (Dec. 1) to 6.0 million in 1967. Numbers rose rapidly in 1969 and 1970, reaching 7.7 million in the latter year. Commercial hog marketings ranged from 6.5 million to 8.2 million during the 1960's and rose to 8.7 million in 1970. Most of the year-to-year fluctuations in hog numbers took place in the Prairie Provinces, where the share of the hog population rose from a low of 37 percent in 1962 to 51 percent in 1970. According to 1970 marketings, the most important hog-producing region is Ontario with one-third of the total, followed by Other Canada (mostly Quebec) and Alberta.

Changes in hog production during 1960-69 are shown in table 16 and figure 11. Throughout the decade, the largest increases in numbers and marketings occurred in Ontario and Other Canada (mostly Quebec), but big increases were also recorded in Manitoba and Saskatchewan. The largest average annual percentage growth was in Manitoba, followed by Other Canada. Alberta hog numbers tended to increase at a very slow rate during the 1960's (1960-68 data would show a declining trend), and commercial hog marketings in the Province declined over the decade.

IV. FACTORS RESPONSIBLE FOR RECENT SHIFTS IN PRODUCTION PATTERNS

Chapter III outlined the major shifts that occurred in grain acreage and beef cattle and hog production in Canada during 1960-70. This chapter analyzes three main groups of causes of these shifts: (1) Changing costs and returns; (2) changing technology; and (3) institutional factors, which include marketing arrangements and Government policies.

Changing Costs and Returns

An examination of changes in production costs and in returns on various commodities during 1960-70 confirms that: (1) Those Prairie crops receiving the highest gross returns per acre had the most rapid percentage increases in acreage; (2) in the Prairies, net returns on barley, whose acreage increased rapidly, were higher than on oats, whose acreage declined; (3) in Ontario, the highest returns were associated with corn, whose acreage grew rapidly; and (4) increased cattle production was accompanied by steadily increasing prices. The more rapidly growing Alberta cattle enterprises appear to have had better net returns than Ontario enterprises; and the growth in Manitoba and Saskatchewan hog production was associated with a tendency for Winnipeg hog prices to increase relative to Toronto prices. Data for measuring these changes come from (1) gross returns per acre of crops or average price per hundred weight (cwt.) of beef or pork and (2) various studies of costs and returns.

Gross returns per acre are based on average farm-gate prices and average yields. For the Prairie Provinces, returns per acre were adjusted for acreage in summer fallow by allocating this acreage among the five principal crops (wheat, barley, oats, rapeseed, and flaxseed). Allocation was made according to the share of each crop's acreage seeded on summer fallow as a percentage of the total area seeded on fallow for the five crops. 22/ Returns from livestock production cannot be readily allocated to a per-acre basis. The best indicator of per-unit returns are the average annual prices per cwt.

22/ If wheat accounted for 80 percent of the acreage seeded on summer fallow for the 5 principal crops in any one year, 80 percent of that year's summer fallow acreage would be allocated to wheat; and in the calculation of returns per acre, wheat returns would be spread over acreage actually seeded to wheat plus 80 percent of the acreage left in summer fallow that year.

of Choice steers, Good feeder cattle, and index-100 hogs 23/ at representative eastern and western terminal markets.

The principal sources of cost and returns data were an intensive study by William J. Craddock (63), farm management studies conducted by the Economics Branch of the Canada Department of Agriculture (CDA), and Provincial farm management and accounting projects. These studies were conducted for different reasons and used different methodologies and so are not really comparable with one another. However, where possible, data from some studies were adjusted to make them more nearly comparable with other studies. All studies assumed an available market for all production.

Prairie Grains and Competing Commodities

Gross returns per acre.--Table 17, which shows gross returns per acre for the five major crops and for total field crops in the Prairie Provinces for 1960-68, indicates that: (1) Returns per acre varied considerably from year to year and among commodities; (2) with some exceptions, returns for all commodities tended to follow the same trends over time; (3) returns by Province varied, but Manitoba generally had the highest returns per acre and Saskatchewan had the lowest; and (4) no single commodity consistently yielded the highest returns, but barley, and to a lesser extent flaxseed and rapeseed, yielded higher returns than wheat or oats.

The last observation is consistent with the precentage growth rate for crop acreage in the Prairies discussed in chapter III. The relatively low returns for wheat were not in accord with the pattern of absolute acreage expansion. In addition, the relatively moderate returns from barley in Manitoba and Saskatchewan do not explain that commodity's rapid growth in those two Provinces.

Production costs and net returns per acre.--Table 18 summarizes the findings of six cost and return studies, two of which are summaries of several other studies. Data are presented by type of enterprise, year, and Province. The most useful data are those calculated from the Craddock study, which contains 1966 production cost data, gathered in part by 493 mail questionnaires. Data were obtained for both "small" and "large" farms, but only those for the large farms--that is, farms with 650 acres in grain and summer fallow in Manitoba and farms with 850 acres in Saskatchewan and Alberta--are shown in the present report. Costs were calculated for 188 producing regions in Canada, including 48 in the Prairies. For table 18, averages for each of the Prairie Provinces are shown. Yields for 1966 were based on trend values, not actual yields. These trend values, particularly for wheat, are somewhat below actual 1965-67 average yields. Craddock's calculations include costs for machinery (for example, depreciation, interest, operation, and repairs), labor, fertilizer, chemicals, and seed. Land use, building costs, management returns, land taxes, and off-farm trucking costs were not included. Craddock's cost figures include some fixed costs (depreciation and investment return on machinery and operator labor) which could not be separated out. Craddock did not calculate gross receipts or returns, so average 1965-67 farm prices per bushel--as reported by Dominion Bureau of Statistics (DBS)--times Craddock's yield assumptions were used to obtain estimates.

Principal observations from table 18 are: (1) Costs increased over time; (2) production costs were lowest in Saskatchewan; (3) wheat production costs were lower

23/ The norm upon which prices are based is the hog grading system adopted on Dec. 31, 1968. The hog grading system is explained on p. 71.

Table 17.--Gross returns per acre for selected crops, Prairie Provinces, Canada, 1960-69 1/

Commodity and region	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969
	Canadian dollars per acre									
Wheat	19.04	9.86	18.99	25.16	18.02	21.54	28.62	18.35	16.59	18.46
Barley	15.67	13.67	19.90	24.03	22.01	26.63	32.09	19.74	21.97	18.01
Oats	17.60	11.59	19.56	19.90	20.29	26.21	27.03	20.23	18.97	20.52
Flaxseed	16.05	14.33	22.84	24.87	20.98	25.32	24.63	20.11	27.50	19.78
Rapeseed	13.34	15.40	18.53	25.63	30.56	24.15	26.71	19.22	20.90	22.35
Total field crops:										
Manitoba	21.15	12.33	26.09	21.18	26.02	27.74	27.79	26.70	25.07	21.01
Saskatchewan	18.20	8.10	18.45	26.05	16.55	21.75	28.66	16.32	15.85	19.51
Alberta	18.32	18.18	20.40	24.25	22.62	25.72	30.55	22.75	22.84	20.89
Total	18.67	11.82	20.15	24.80	19.77	23.84	29.11	19.79	19.33	20.15

1/ Acreage includes land in summer fallow which was allocated to each crop in proportion to its use of summer fallow.

Source: Calculated from (216).

Table 18.--Costs and returns, grain and oilseed production, Prairie Provinces, Canada, 1960-68

Commodity or farm type and year	Location	Number of farms	Costs and returns			Source
			Variable costs	Gross receipts	Return over variable costs	
			Canadian dollars per acre			
Grain and oilseed crops:						
1964.	Saskatchewan	n.a.	6.38	16.86	10.48	(162)
1965.	"	n.a.	6.82	22.97	16.15	"
1966.	"	n.a.	7.09	27.42	20.33	"
1967.	"	n.a.	7.59	20.88	13.29	"
1968.	"	131	7.73	20.17	12.44	"
Crop enterprises:						
1967.	Alberta	1/354	8.60	23.81	15.21	(7)
Commercial wheat farms:						
1968.	Elbow-Hawarden, Sask.	50	5.20	2/13.34	8.14	(138)
Wheat farms:						
1968.	Wynyard, Sask.	45	8.23	2/23.48	15.25	(139)
Grain farms:						
1961.	Swift Current, Sask.	60	4.32	2/15.81	11.49	(107)
1963.	Gull Lake-Maple Cr., Sask.	38	4.23	2/13.16	8.93	"
1960.	Rosetown-Elrose, Sask.	50	6.15	2/16.25	10.10	"
1965.	" " "	40	6.67	2/20.80	14.13	"
1962.	Asquith-Delisle, Sask.	31	4.17	2/13.98	9.81	"
1964.	Davidson, Sask.	40	4.71	2/15.45	10.74	"
1962.	Red River Valley, Man.	49	11.34	2/24.07	12.73	"
1964.	Somerset-Manitou, Man.	19	9.72	2/24.19	14.47	"
1965.	Reston-Cromer, Man.	10	7.31	2/21.87	14.56	
			Total costs excl. land and buildings 3/	Gross receipts 4/	Returns over costs excl. land	
			Canadian dollars per acre			
Wheat:						
1966.	Manitoba	*	7.54	22.31	14.77	(63)
1966.	Saskatchewan	*	4.97	17.34	12.37	"
1966.	Alberta	*	6.16	20.42	14.26	"
Barley:						
1966.	Manitoba	*	8.01	18.58	10.57	"
1966.	Saskatchewan	*	5.60	17.35	11.75	"
1966.	Alberta	*	8.10	20.74	12.64	"
Oats:						
1966.	Manitoba	*	8.38	19.51	11.13	"
1966.	Saskatchewan	*	5.54	15.64	10.10	"
1966.	Alberta	*	7.82	19.80	11.98	"

* Not applicable.
n.a. means not available.

1/ Larger than average capital investment and gross receipts.
2/ Gross receipts calculated on basis of 1947-66 average yields, but prices are from the year of the study.
3/ Costs per acre covers acres left in summer fallow and the costs of summer fallowing. Costs include machinery (depreciation, investment, and operating costs), labor, chemicals, and seeds. Management returns and off-farm trucking not included.
4/ Gross receipts based on trend values of yield calculated by Craddock times 1965-67 average farm prices per bushel.

Sources: (7, pp. 33-40; 63; 107; 138; 139; 162, pp. 5, 8-10).

than barley or oats costs; 24/ (4) returns varied considerably from year to year; (5) returns for wheat were superior to those received for barley or oats; and (6) returns for barley and oats were best in Alberta.

Only some of these observations help explain acreage trends in the Prairies. That net returns for wheat are higher in all Provinces than for barley or oats tends to explain the large increases in wheat acreage through the 1960's, but not the even larger growth in barley acreage during the decade.

Corn and Competing Commodities in Ontario

Gross returns per acre.--Table 19 shows that for corn, five principal competing crops, and all field crops in Ontario: (1) The highest receipts per acre were consistently obtained by grain corn; (2) the next highest receipts were for wheat and soybeans; (3) receipts for all commodities tended to increase except during 1966-69, when they leveled off; (4) receipts for all commodities, but especially corn and soybeans, tended to follow the same year-to-year trend; and (5) receipts per acre for principal crops in Ontario are not nearly as irregular as those in the Prairie Provinces.

The consistently high receipts for corn may partly explain the rapid growth of Ontario corn acreage since 1960, but nothing in the table of gross returns can explain the similar rapid increase in Ontario barley acreage. Most of the 1960-70 acreage shifts must be explained by some factor other than gross returns per acre.

Production costs and net returns per acre.--The results of four cost and return studies for crops in Ontario are summarized in table 20. As in the Prairie Provinces' costs and returns table, the data based on the Craddock study (63) are the most useful. Previous comments on the Craddock costs and returns data for the Prairie Provinces hold for Ontario, except that the data are for farms having 238 acres in grain crops, and costs and returns do not cover summer fallow land, which is not important in eastern Canada.

Principal observations from table 20 are: (1) Costs of corn production are higher than for any other commodity listed; (2) soybeans, barley, winter wheat, oats, and mixed grains have similar production costs; (3) feed crop production costs rose during 1966-69; (4) net returns for corn were substantially higher than for other grains, but not necessarily higher than those for soybeans; (5) soybeans and winter wheat returns per acre were better than barley's; and (6) returns for oats and mixed grains were low.

High net returns for corn and soybeans were consistent with the rapid acreage increases for those crops during the 1960's. Relatively low returns for barley and mixed grains, however, do not correlate with their large acreage increases (barley's growth might be explained, in part, by its being the most efficient feed crop in areas unable to grown corn). Low returns for oats correspond to the rapid decline in oats acreage.

Cattle and Calves

Cattle prices.--Table 21 shows that: (1) Both feeder and slaughter cattle prices trended sharply upward during 1960-70; and (2) after 1966, feeder cattle prices increased more rapidly than slaughter cattle prices.

24/ Craddock gives no explanation for this unexpected phenomenom other than citing higher harvesting costs for higher yielding grains. Another partial explanation could be that a relatively large proportion of wheat is grown on light soils, where per-acre costs are lower, and a relatively large portion of barley and oats is grown on heavy soils, where per-acre costs are higher.

Table 19.--Gross returns per acre for selected crops, Ontario, Canada, 1960-70

Commodity	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970
	Canadian dollars per acre										
Grain corn. . . .	70.80	88.90	97.70	90.00	105.40	104.30	121.10	106.30	105.28	96.13	109.65
Winter wheat. . .	48.20	51.30	59.70	68.30	67.40	60.90	79.70	70.00	70.02	68.06	70.68
Barley.	39.40	45.00	49.70	47.30	49.80	56.10	51.70	55.10	57.66	36.00	53.50
Oats.	37.90	41.00	42.40	38.60	39.40	44.90	40.30	44.70	45.97	38.02	42.49
Soybeans.	45.00	70.40	74.20	61.30	86.70	80.30	96.10	74.50	74.66	56.65	79.98
Mixed grains. . .	42.80	46.10	49.00	47.90	47.40	52.50	46.00	52.50	54.21	50.31	55.15
All field crops 1/	40.08	44.63	47.37	50.68	56.61	58.95	60.54	60.79	59.45	58.94	n.a.

n.a. means not available.

1/ Does not include tobacco.

Sources: (216; 227).

Table 20.--Costs and returns, grain and oilseed production, Ontario, Canada, 1961-69

Commodity and year	Number of farms	Costs and returns			Source
		Variable costs	Gross receipts	Return over variable costs	
		- - - Canadian dollars per acre - - -			
Corn:					
1966	*	1/34.62	2/105.19	70.57	(63)
1967	3/36	51.75	4/118.13	66.38	(74)
Soybeans:					
1961	5/5	25.00	4/88.00	63.00	(2)
1962	5/10	18.00	4/77.00	59.00	"
1963	5/9	17.00	4/82.00	65.00	"
1964	5/11	22.00	4/86.00	64.00	"
1965	5/9	21.00	4/63.00	42.00	"
Barley:					
1966	*	1/15.94	2/52.51	36.57	(63)
Winter wheat:					
1966	*	1/17.34	2/63.89	46.55	"
Oats:					
1966	*	1/18.39	2/42.31	23.96	"
Mixed grains:					
1966	*	1/19.12	2/50.51	31.39	"
Feed crops for feed:					
1966	522	18.00	41.00	23.00	(6)
1967	358	20.00	46.00	26.00	"
1968	421	24.00	51.00	27.00	"
1969	366	26.00	52.00	26.00	"
Feed crops for sale:					
1966	11	30.00	67.00	37.00	"
1967	16	33.00	99.00	66.00	"
1969	20	54.00	108.00	53.00	"

* Not applicable.

1/ Includes all costs except management, land investment, land taxes, charges for buildings, and off-farm trucking.
2/ Yield based on trend values. Value per bushel as reported in (227).
3/ Middlesex, Oxford, and Brant counties.
4/ Value per bushel as reported in (227).
5/ Elgin County only.

Sources: (2; 6; 63; 74).

Table 21.--Average annual cattle prices at Calgary and Toronto, Canada, 1960-70

Year	Good feeder steers		Choice slaughter steers		Difference between slaughter and feeder steers 1/	
	Calgary	Toronto	Calgary	Toronto	Calgary	Toronto
	Canadian dollars per cwt.					
1960. .	19.90	22.90	21.85	23.75	1.95	0.85
1961. .	20.50	22.70	21.75	24.20	1.50	1.50
1962. .	24.20	24.90	25.60	27.20	1.40	2.30
1963. .	23.25	25.30	23.25	25.05	--	(.25)
1964. .	20.70	22.80	21.95	24.05	1.25	1.25
1965. .	21.95	22.70	23.60	25.20	1.65	2.50
1966. .	24.90	27.70	25.50	27.05	0.60	(.65)
1967. .	26.40	28.70	26.65	28.80	.25	.10
1968. .	26.40	28.45	26.55	28.45	.15	--
1969. .	31.25	31.60	28.65	31.10	(2.60)	(.50)
1970. .	32.40	33.95	29.90	32.25	(2.50)	(1.70)

1/ Numbers in parentheses indicate that feeder cattle price is higher than slaughter cattle price.

Sources: (198; 199; 208).

Changes in gross receipts per cwt. of cattle help to explain production shifts since 1960, but they also reflect shifts in cattle production patterns that were caused by other factors. The 1960-70 trend of increased production was to some extent a response to the rapid rise in prices. The decline in cattle numbers during 1965-68 was caused partially by the heavy demand for feeder cattle. This demand is reflected in the rise in feeder cattle prices and the elimination of the feeder cattle-slaughter cattle price margin beginning in 1966. Producers apparently expected the high prices to be temporary and hoped to profit from them by decreasing herd size. The 1969 and and 1970 price increases reflect decreased supplies that were due to increased retention of female animals for breeding purposes.

Costs and returns from cow-calf operations.--Table 22 summarizes results from various cost and return studies of cow-calf operations in Canada. In these studies, results are given in terms of costs and returns per cow (variously defined as a breeding animal, a cow wintered, or just plain cows). Principal observations are: (1) Net returns in Ontario showed no improvement during 1966-69; (2) returns from Ontario cow-calf operations were apparently lower than from western Canadian operations; and (3) costs, receipts, and net returns in Alberta all increased during 1965-69. The growth in net returns indicated by the Alberta Cow-Calf Enterprise Analysis (110), and the stagnancy and lower levels of the Ontario returns are in accord with the relative growth rates in the cow-calf industries of the two Provinces.

Costs and returns from cattle-feeding operations.--The results of five cost and return studies for cattle-feeding operations are shown in table 23. Feed costs are shown separately because they are the most important and usually the most variable element in cattle-feeding costs. Costs and returns are shown on a per-cwt. gain basis. Principal observations from the table are: (1) No definite upward or downward trend occurred in costs or returns; (2) returns, particularly in Ontario, vary widely from year to year; and (3) production costs in Ontario are apparently higher than those in

Table 22.--Costs and returns, cow-calf operations, Canada, 1960-69

Location and year	Number of farms	Costs and returns: Variable costs	Gross receipts	Return over variable costs	Source
		- - Canadian dollars per cow - -			
Ontario:					
1966	6	133	110	-23	(6)
1967	4	131	130	-1	(6)
1968	4	117	103	-13	(6)
West Central Manitoba:					
1964-66	13	74	79	5	(102)
Saskatchewan:					
1968	13	67	103	36	(162)
Southern Alberta:					
1960	1/	53	80	27	(122)
1961	1/	53	85	32	(122)
1962	1/	58	96	39	(122)
1963	1/	58	94	36	(122)
1964	1/	59	77	18	(122)
1965	1/	59	80	21	(122)
Alberta:					
1965	94	63	81	18	(110)
1965-67	95	67	93	27	(110)
1968	84	69	103	34	(110)
1969	n.a.	93	152	59	(110)

n.a. means not available.

1/ Hypothetical operations with 85-percent calf crop, 16-percent replacement rate, weights, and prices based on records for the region.

Sources: (6; 102; 110; 122; 162)

Alberta. These observations confirm that lower production costs in Alberta relative to those in Ontario were one reason for the rapid growth of cattle feeding in Alberta during the 1960's.

Hogs

Hog prices and feed costs.--Hog prices, the hog-barley ratio, 25/ and the Ontario hog-corn ratio 26/ (table 24) are indicators of returns received by Canadian hog producers. The hog-grading system changed in 1969, so prices and feed-price ratios for 1969, 1970, and 1971 are not fully comparable with those of earlier years. The hog-barley and hog-corn ratios are not comparable with each other because of different bushel weights and nutritive values of the two feeds. In addition, the prices upon which they are based are not necessarily indicative of what farmers actually pay for feed, much of which is grown on farms where fed.

25/ Bushels of No. 1 Feed Barley, basis Thunder Bay prices, that are equal in value to 100 pounds of index-100 (grade B) live hog.

26/ Bushels of No. 2 C.E. Corn, basis Chatham, Ont., prices, that are equal in value to 100 pounds of index-100 (grade B) live hog.

Table 23.--Costs and returns, cattle-feeding operations, Canada, 1960-68

Location and year	Number of farms	Costs and returns: Feed costs	All variable costs	Gross receipts	Return over variable costs	Source
		- - Canadian dollars per cwt. gain - -				
Ontario:						
1966.	10	21	23	25	2	(6)
1967.	7	21	23	24	1	(6)
1968.	9	25	27	34	7	(6)
1969.	10	19	20	27	6	(6)
Eastern Ontario:						
1965.	1/18	23	26	36	9	(20)
Alberta:						
1963 2/ . . .	84	20	24	3/26	2	(89)
1965-67 . . .	60	18	20	4/27	7	(84)
1967.	36	18	20	4/25	5	(84)
1968.	50	17	20	4/25	5	(111)

1/ Farms buying and selling cattle the year round.
2/ Year ending July 1, 1963.
3/ Year of study one of below average receipts. Gross receipts include the value of manure produced from feeding operation.
4/ No adjustment made for differences between purchase and selling price.

Sources: (6; 20; 84; 89; 111)

Hog prices, an indicator of gross receipts, tended to vary from year to year, with peaks being reached in 1966 and 1969. The wide margins between Winnipeg and Toronto prices in 1970 and 1971 reflect greatly expanded hog production in western Canada. The low 1969 spread between the two markets was due to the heavy demand for breeding animals in the Prairies that year. Before 1969, the price spread between the two markets was tending to narrow. The hog-barley and hog-corn ratios are most favorable to hog producers when they are high. Thus, Ontario hog producers feeding corn had more favorable conditions in the late 1960's and in 1970 than earlier in the decade. Producers feeding barley (includes many in eastern Canada and almost all in western Canada) had very poor conditions in early 1971, but otherwise no trend is discernible.

Prices and feed-price ratios help to explain some of Canada's hog production trends during the 1960's. The narrowing of the Winnipeg-Toronto price spread before 1969 correlates with the rapid growth of the Manitoba and Saskatchewan hog industries, and the increasingly favorable hog-corn ratio is in line with the large increase in Ontario hog numbers and marketings.

Costs and returns from hog-raising operations.--The three cost and return studies for hog production summarized in table 25 are based on conventional enterprises as well as specialized enterprises producing weanling pigs or feeding weaned pigs. Stephens' studies on all three types of enterprises in Ontario found little difference in profitability among them (173; 174; 175).

Looking at the table, note: (1) no time trend can be isolated for costs or returns, and (2) production costs in Saskatchewan are apparently less than in Ontario. Only the relatively lower Saskatchewan production costs can be correlated to any of the production trends during the 1960's.

Table 24.--Average annual hog prices at Toronto and Winnipeg, hog-barley ratio in Winnipeg, and hog-corn ratio in Toronto, 1960-71

Year	Index-100 hogs 1/			Hog-barley ratio, 2/ Winnipeg	Hog-corn ratio, 3/ Toronto
	Winnipeg	Toronto	Difference		
	- Canadian dollars per cwt. -			- - - Ratio - - -	
1960	21.65	23.75	2.10	18.7	19.6
1961	24.85	27.30	2.45	18.6	22.0
1962	25.65	28.60	2.95	16.3	21.8
1963	24.80	26.80	2.00	17.3	18.7
1964	23.55	26.30	2.75	16.2	18.9
1965	30.65	32.40	1.75	19.1	22.5
1966	33.45	34.90	1.45	20.3	23.7
1967	27.55	29.70	2.15	17.5	20.2
1968	28.10	29.80	1.70	19.9	23.8
1969	35.45	35.70	0.25	28.2	26.1
1970	29.20	32.20	3.00	21.7	23.5
1971 4/	22.17	25.57	3.40	13.9	n.a.

1/ Grade B before 1969. Index-100 hogs are of lower quality than those previously graded as B.

2/ Bushels of No. 1 Feed Barley, Thunder Bay, that are equal in value to 100 pounds of index-100 (grade B) live hog.

3/ Bushels of No. 2 C.E. Corn, Chatham, Ont., that are equal in value to 100 pounds of index-100 (grade B) live hog.

4/ Jan.-Mar. only.

Sources: (198; 199; 208; 214).

Table 25.--Costs and returns, hog raising operations, Canada, 1959-69

Type of enterprise, Province, and year	Number of farms	Costs and returns: Feed costs	Variable costs	Gross receipts	Return over variable costs	Source
		Canadian dollars per sow				
Conventional enterprises:						
Ontario--						
1959-63	110	n.a.	379	579	200	(173)
1966	33	482	507	806	299	(6)
1967	40	458	479	647	168	"
1968	52	466	493	766	272	"
1969	38	591	626	1,100	474	"
Saskatchewan--						
1968	5	239	300	424	124	(162)
Weanling pig enterprises:						
Ontario--						
1959-63	65	n.a.	136	232	97	(173)
1967	15	175	185	284	99	(6)
1968	13	150	166	380	214	"
1969	13	179	193	363	170	"
Feeder pig enterprises:		Canadian dollars per pig				
Ontario--						
1959-63	96	n.a.	20	29	9	(173)
1966	56	22	23	30	7	(6)
1967	56	22	23	28	5	"
1968	63	30	32	45	12	"
1969	37	26	29	40	11	"
Saskatchewan--						
1968	8	19	23	31	8	(162)

n.a. means not available.

Sources: (6; 162; 173).

Changing Technology

Much of Canada's rapid agricultural growth between 1960 and 1970 was the result of changes in agricultural technology. New production techniques have been introduced and farmers have adopted known techniques not previously used. Technical change is usually associated with increased use of various inputs, but it can also involve changes in management practices, many of which are not readily measurable.

This section identifies specific instances of increased productivity in grain, cattle, and hog production and examines changes in technology that may have been associated with the productivity climb.

Grains

The principal indicators of increased productivity in grain production are trends in yields per acre. Although yields of the major Canadian grain crops fluctuated from year to year during 1960-70, especially in the Prairie Provinces, they all trended upward (table 26). (Average yields for the entire period are shown in app. table 5.) The upward trends for wheat and oats, however, were not as important as year-to-year fluctuations. Not all the recorded increases were necessarily due to improved technology and management practices. Some of the increases could have been due to more favorable weather in the later years. However, a study on Prairie wheat yields and weather attributes some of the yield improvement to nonweather factors. The study found that average yields over 1960-70 were about 1 bushel per acre higher than weather-based estimates would indicate (183). Average annual yield increases for barley, at 3.2 percent over 1960-70, were higher than for any other grain. Corn yield improvement, at 2.5 percent a year, was also rapid. Within the Prairies, wheat and barley yields increased most rapidly in Alberta.

Table 26.--Average annual increase in yields per acre of principal grains, by principal producing regions, Canada, 1960-70 1/

Region	Wheat	Barley	Oats	Corn
	Percent			
Manitoba	0.5	2.4	1.1	
Saskatchewan	1.7	3.2	2.3	
Alberta	3.2	3.4	2.2	
Prairie Provinces	1.9	3.2	1.9	
Ontario				2.5

1/ Average annual increase based on trend values, not actual yields. Drought year of 1961 was excluded from wheat, barley, and oats trends.

Source: (216).

Changes in technology responsible for grain yield improvements through the 1960's can be identified in part by examining trends in input use. The most important changes are: (1) The introduction of higher yielding varieties of wheat and barley; (2) new grain corn varieties able to mature in areas with shorter, cooler, growing seasons; (3) greatly increased fertilizer use in all regions; (4) increased use of herbicides on wheat, barley, and corn; (5) more machinery on farms; and (6) more powerful tractors on farms.

New grain varieties.--The principal role of new grain varieties in the Prairie Provinces during the 1960's was to allow yields to be maintained by improving crop resistance to disease and pests. However, some new varieties have led to increased yields. The use of Manitou, a popular hard red spring wheat, led to a slight net improvement in wheat yields in the Prairies. Neepawa, another hard red spring, licensed for Prairie use in 1969, achieved a 4- or 5-percent yield improvement over other varieties in 1969 and 1970. Feed wheats have not been a factor in yield improvements to date. Conquest and Bonanza, two popular varieties of barley introduced in western Canada during the 1960's, led to very slight yield increases.

The most important development in grain corn varieties was the introduction of new flint types adaptable to a short growing season. These were responsible for the northward expansion of corn acreage in Ontario and Quebec.

Increased use of purchased seed has apparently been a very minor factor in increased grain yields in Canada. Apparently, very few grain producers in western Canada use purchased seed on a regular basis (138; 139). Purchases of wheat, barley, and oats for seed represent only a small portion of total acreage seeded to those crops (grain seed purchases per acre are shown in app. table 6). Nevertheless, the quality of seed being planted in the Prairies appears to be improving. A 1968 study concluded that Alberta farmers were then using better seed than 15 years earlier. Increased patronage of seed cleaning plants is reportedly a major factor behind this improvement (240, Mar. 1969). Expenditures on corn for seed are high because of the dependence on hybrid varieties. Periodic increases in the purchases of seed, other than corn, are correlated with the introduction of new varieties.

Fertilizer use.--Sales of fertilizer nutrients per acre of field crops almost tripled between 1960 and 1968, but in 1969 declined to 2-1/2 times the 1960 level (table 27). 27/ Fertilizer use is heaviest in Ontario, but the most dramatic percentage increases in use have been in the Prairie Provinces, where volume of sales per seeded acre increased five times between 1960 and 1968. Despite the rapid increase in fertilizer use in the Prairie Provinces, the total amount used remains relatively small, and in 1968 it was estimated that increased fertilizer use had no significant effect on average grain yields before 1967 (85).

In eastern Canada, fertilizer is used heavily on corn, soybeans, tobacco, and potatoes. Corn and soybeans have accounted for much of the increase in fertilizer use, and improvements in their yields are attributable in part to this. Fertilizer use on tobacco and potatoes has been static.

Pesticide use.--Canadian sales of pest-control products for agricultural use more than doubled during the 1960's (table 28). No index of pesticide prices is available, but an examination of products accounting for over 20 percent of 1969 agricultural

27/ Decreased fertilizer sales in the Prairie Provinces in 1969 and 1970 are associated with the development of large grain surpluses.

Table 27.--Fertilizer sales per seeded acre of field crops, by region, Canada, 1960-70

Year 1/	Prairie Provinces				Ontario	Other Canada	Total
	Manitoba	Saskatchewan	Alberta	Total			
	Pounds of nutrient content per seeded acre						
1960. . . .	3.1	1.6	5.1	2.9	36.8	30.0	10.3
1961. . . .	4.2	1.9	6.5	3.8	42.5	35.3	12.5
1962. . . .	4.5	2.2	7.6	4.3	46.3	37.1	13.1
1963. . . .	6.0	3.2	9.9	5.8	51.6	36.8	14.8
1964. . . .	7.0	5.1	12.4	7.8	59.8	38.1	17.4
1965. . . .	8.8	5.7	13.6	8.8	65.2	42.8	19.2
1966. . . .	16.9	8.3	16.0	12.2	70.3	50.1	22.8
1967. . . .	20.0	10.4	20.1	15.2	81.9	53.8	27.0
1968. . . .	26.3	10.9	23.0	17.4	89.1	54.8	29.4
1969. . . .	15.8	5.6	17.5	11.3	86.9	31.0	25.3
1970 2/ . .							

1/ Fertilizer sales are for years ending June 30.
2/ Nutrient content data not available at time of writing, but total fertilizer sales decreased in the Prairie Provinces and showed a large increase in Ontario, while Other Canada and total sales remained about the same.

Sources: Calculated from (207) and (216).

Table 28.--Sales of pest-control products for agricultural use, by type, Canada, 1960-69

Year 1/	Insecticides	Fungicides	Herbicides	Livestock treatments	Total 2/
	Can$1,000				
1960. .:	4,364	5,508	8,396	1,889	20,157
1961. .:	7,267	5,062	10,295	2,420	25,044
1962. .:	7,679	6,012	11,334	3,382	28,407
1963. .:	7,642	5,828	12,736	2,503	28,709
1964. .:	5,355	4,931	14,561	2,370	27,217
1965. .:	5,110	4,983	17,194	2,641	29,928
1966. .:	n.a.	n.a.	n.a.	n.a.	40,228
1967. .:	n.a.	n.a.	n.a.	n.a.	45,581
1968. .:	7,048	5,346	34,672	6,775	53,841
1969. .:	7,105	5,997	27,524	5,512	46,138

1/ Years ending Sept. 30.
2/ Does not include rodenticides for agricultural use, whose sales amount to approximately one-half million dollars a year.

Source: (209).

pesticide sales indicates there was no price increase per unit between 1960 and 1969. 28/ Most of the sales increase was accounted for by herbicides (weed-control chemicals), which made up 60 percent of total sales in 1969, and livestock treatments. Herbicides are used mainly on grain crops, including corn, although oats is seldom sprayed. In 1968, an estimated 31 million acres of Prairie cropland (of a total 52 million acres) were treated with herbicides (64).

Mechanization--Increased mechanization is not usually as closely related to yield improvements as are increases in the use of purchased seed, fertilizers, and pesticides. A main effect of mechanization is to save labor and thus contribute to higher output per worker. While the level of Canadian agricultural production was increasing during the 1960's, the number of workers employed in agriculture declined by 25 percent (table 29).

Table 29.--Employed labor force in agriculture, by region, Canada, 1960 and 1970 1/

Region	1960	1970
	1,000 workers	
Prairie Provinces	285	227
Ontario	179	132
Other Canada	219	154
Total Canada	683	513

1/ Annual averages; includes paid workers, self-employed workers, and unpaid family workers.

Source: (210).

Tables 30 and 31 show several indicators of change in the use of tractors and other farm machinery in Canada during the 1960's. The data in table 30 measuring the value of machinery on farms, are not adjusted for price changes. The price index in the table is from the DBS index, which has a 1935-39 base. Because this index is based on a product mix prevailing 35 years ago, it is considered reliable only as a very rough guide. It shows increases of 28 percent between 1960 and 1969. Canada has no import duty on farm machinery, and tractor and combine prices are about the same as in the United States (11, pp. 21, 25, 31).

Total value of farm machinery on farms rose from Can$2.6 billion to Can$4.3 billion during the 1960's--a substantial real increase even when price increases are taken into account. The value of machinery per acre of crops and fallow increased considerably in all regions. The more extensive nature of Prairie farming is indicated by the lower inventory of machinery per acre there. All regions increased their machinery stock per worker at similar rates.

Comparison of the 1961 and 1966 Canadian censuses of agriculture indicates moderate increases in the number of trucks, tractors, and combines on farms. The amount of farmland for each tractor declined slightly in each region, but the rapid increase in grain acreage during the intercensal period led to an increase in the amount of grainland 29/ for each combine in the Prairie Provinces.

28/ Based on calculations from (209).
29/ Land seeded to wheat, oats for grain, barley, mixed grains, rye, buckwheat, flaxseed, and rapeseed.

Table 30.--Value of farm machinery on farms, by region, Canada, 1960 and 1969

Item and region	1960	1969
	Can$1 million	
Total value:		
Prairie Provinces	1,494	2,596
Ontario	597	924
Other Canada	484	765
Total Canada	2,575	4,285
	Canadian dollars	
Value per acre:		
Prairie Provinces	21	33
Ontario	79	123
Other Canada	70	116
Total Canada	30	46
Value per worker:		
Prairie Provinces	5,242	10,683
Ontario	3,335	6,794
Other Canada	2,210	4,904
Total Canada	3,770	8,009
Index or prices paid by farmers for farm machinery (1960 = 100 1/)	100.0	127.9

1/ From Dominion Bureau of Statistics series based on 1935-39.

Sources: (210; 216).

During the 1960's, the most dramatic change to occur in machinery use was the introduction of more powerful tractors. Over 70 percent of the tractors sold in Canada in 1960 were in the 20- to 40-horsepower range, and only 4.8 percent were rated 55 horsepower or over. By 1969, 45 percent of tractors sold were models with 60 or more horsepower. Machines sold in the Prairie Provinces were more powerful than those sold elsewhere, but growth in sales of high-horsepower tractors occurred all over the country (206).

Cattle and Calves

Changes in livestock productivity are difficult to isolate and measure. One indicator of cattle productivity change is the number of cattle marketed per 100 cows, but with available statistics it is not possible to separate beef productivity changes from changes in the structure of the dairy industry. Measures of output per unit of labor or per acre of land are not available.

Table 31.--Number of trucks, tractors, and grain combines on farms, by region, Canada, 1961 and 1966 1/

Item and year	Prairie Provinces	Ontario	Other Canada	Total Canada
		Number		
Trucks:				
1961	185,983	62,812	53,217	302,012
1966	224,718	67,622	52,496	344,836
Tractors:				
1961	290,700	150,046	109,043	549,789
1966	312,705	162,303	123,475	598,483
Grain combines:				
1961	127,276	22,387	5,948	155,611
1966	134,797	23,372	12,012	170,181
		Acres		
Improved farmland per tractor:				
1961	276	80	101	188
1966	272	74	89	181
Grainland per combine: 2/				
1961	322	146	342	298
1966	345	109	152	300

1/ As of June 1.

2/ Land planted in wheat, oats for grain, barley, mixed grains, rye, buckwheat, flaxseed, and rapeseed.

Sources: (201; 204).

Nevertheless, it can be assumed that beef cattle productivity in Canada has increased since 1960. The following tabulation, which compares beef cattle production increases and input changes, gives a rough idea of the magnitude of the productivity changes:

Item	Total percentage change, 1960-69
	Percent
Production of beef (lbs.)	42.3
Cow numbers	19.6
Area in forage crops	6.5
	Total percentage change, 1961-66
	Percent
Number of farms reporting cattle	-16.3
Total pasture acreage	0.9
Unimproved pasture acreage	-0.2
Improved pasture acreage	6.8

Sources: Calculated from (201; 203; 204; 208; 216).

Beef output increased much more rapidly than did the total cattle population or land inputs, primarily because of improved technology in cattle production. However, part of the increase is due to the reduction of the dairy herd throughout the decade and to the reduction of the beef herd between 1965 and 1968. 30/

Another indicator of increased beef cattle productivity is the great improvement in the quality of output between 1960 and 1970. As indicated below, cattle grading Choice and Good, the two top grades, increased from 49 percent of the total inspected slaughter in 1960 to 65 percent in 1970:

Year	Cattle, Choice and Good grades, as a percentage of carcasses graded in federally inspected packing plants
	Percent
1960	49
1961	51
1962	47
1963	52
1964	54
1965	49
1966	52
1967	55
1968	57
1969	63
1970	65

Source: (198) as recorded in (25).

30/ Total dairy cow numbers in Canada declined 13 percent during 1960-69, from 2.97 million to 2.58 million. Beef cow numbers declined from 2.93 million in Dec. 1965, to 2.77 million in Dec. 1968.

The changes in Canadian beef production techniques that are primarily responsible for much of the improvement in quality and quantity of production are discussed below. Generally speaking, these changes parallel those in the United States, except they are often adopted later and practiced on a smaller scale in Canada.

Increased feedlot finishing.--Increased feedlot finishing, by far the most important change in beef production techniques during the 1960's, is directly related to the increased quality of beef production in Canada. Under the assumption that slaughter cattle grading Good and Choice represent feedlot production, the feedlots' contribution to the Canadian slaughter cattle supply increased from half to almost two-thirds of the total during 1960-70. Feedlot finishing has allowed the industry to produce greater numbers of cattle for slaughter, to market heavier cattle, and to greatly improve the quality of the cattle marketed.

Feeding dairy cattle.--Some increased beef production has come from increased feeding of dairy animals, mostly Holstein, in eastern Canada. An estimated 25 percent of calves in Canada are surplus dairy animals, which in the past ended up as veal, but the trend through the last decade has been to finish these animals for slaughter as beef. Some Holstein calves end up in Ontario feedlots, but many are finished by dairy farmers who are becoming engaged in dual feeding and dairy operations (161).

Finishing cattle to heavier weights.--As indicated below, the average weight of cattle slaughtered in Canada increased 9 percent during 1960-70:

Year	Average cold-dressed weight of cattle slaughtered
	Pounds
1960	512.4
1961	518.8
1962	518.1
1963	530.9
1964	530.3
1965	519.3
1966	533.6
1967	538.1
1968	547.1
1969	553.5
1970	560.7

Source: (208).

This trend, which contributed to the increase in total beef production, has been due to feedlot finishing of animals to heavier weights, a higher percentage of steers being slaughtered, and a higher proportion of beef animals relative to dairy animals being slaughtered (153, p. 2).

Increase in improved pasture.--Between the 1961 and 1966 census years, improved pasture acreage in the Prairie Provinces increased by 32 percent--from 3.8 million to 5.0 million acres. Improved pasture in the rest of Canada decreased somewhat, and unimproved pasture throughout the country changed little. The increase in improved pasture is important because of the much greater productivity of such land--a tripling of grazing capacity, increases in the rate of gain of cattle, and higher calving percentages (182, p. 2).

Larger herds.--Cost and return studies indicate that larger cattle herds, both for breeding and feeding, are more efficient and profitable than smaller herds. Data from the 1961 and 1966 Canadian censuses of agriculture (table 32) indicate that average herd sizes, while remaining relatively small, did increase significantly in the early 1960's. This increase probably led to greater efficiency.

Table 32.--Average number of cattle per farm reporting cattle, by region, Canada, June 1, 1961 and 1966

Region	1961	1966
	- - - Number - - -	
Manitoba	30	41
Saskatchewan	33	44
Alberta	50	65
Prairie Provinces	38	51
Ontario	33	39
Other Canada	23	28
Total Canada	32	41

Sources: (201; 204).

Hogs

As with cattle, indicators of hog productivity changes are difficult to obtain. One potential indicator, hogs marketed per sow kept for breeding, is not available because a complete series of statistics on sows kept for breeding is not available, and marketing statistics do not include noncommercial marketings. As indicated below, Canadian pork production has increased faster than the hog population, and the number of hog producers (farms reporting hogs) declined greatly in the early 1960's:

Item	Total percentage change, 1959-61 to 1967-69 1/
	- - Percent - -
Production of pork (lbs.)	8.5
Hog numbers (June 1)	3.2
	Total percentage change, 1961-66 1/
	- - Percent - -
Number of farms reporting hogs	-30.9

1/ 3-year averages are used to compensate somewhat for hog production cycles.

Pigs saved per sow farrowed, another indicator of productivity changes, showed little change during 1960-70. The slight improvement achieved was mainly in the Prairie Provinces (app. table 7). As indicated below, there was a definite, gradual improvement in the quality of hogs marketed in Canada during 1960-65 and no change in 1965-68:

Year	Hogs grading A and B as a percentage of total commercial marketings
	Percent
1960. .	77
1961. .	78
1962. .	80
1963. .	81
1964. .	81
1965. .	83
1966. .	83
1967. .	83
1968 1/	83

1/ Because of a change in the grading system, no comparable figures for hog quality after 1968 are available.

Source: (208).

The two major changes in Canadian hog production techniques since 1960 are increased specialization and more mechanization.

Specialization.--Two types of increased specialization in hog production have occurred in recent years. The first is the tendency for fewer producers to market more animals. The average number of hogs kept per farm (table 33) increased dramatically (46 percent for all of Canada) during 1961-66. This trend indicates the increasing relative importance of large specialized hog producers and the accompanying decline of hog raising as a secondary farm enterprise. An Ontario hog production study noted that the majority of hogs marketed in most areas of that Province now come from large specialized producers, whereas previously the majority came from small secondary enterprises (61).

Table 33.--Number of hogs per farm reporting hogs, by region, Canada, June 1, 1961 and 1966

Region	1961	1966
	Number	
Manitoba.	20	31
Saskatchewan. . . .	16	18
Alberta	36	38
Prairie Provinces	25	29
Ontario	30	46
Other Canada. . . .	17	34
Total Canada. .	24	35

Sources: (201; 204).

The other important trend toward specialization in hog production has been the rapid growth in the relative importance of producers marketing only weanling or feeder pigs and producers specializing in hog feeding. In the mid-1960's, approximately one-third of Ontario hog production enterprises, accounting for almost one-half of the

slaughter hogs marketed in Ontario, were straight hog-finishing operations. At the same time, one-third of the hog producers having sows marketed only weanling pigs (61).

Mechanization.--During the 1960's, labor requirements were reduced in Canadian hog production enterprises by the introduction of mechanized feed, water, and litter handling and by more modern farrowing facilities and pen arrangements (173). Enterprises with mechanical feeding arrangements, however, had a tendency to produce lower quality carcasses than enterprises with hand-feeding methods (61).

Institutional Factors

Institutional factors, particularly Government agricultural policies and marketing arrangements, have had an important influence on Canadian grain and livestock production patterns since 1960. The discussion of these factors is divided into sections on Prairie grains, Ontario corn, and livestock.

Prairie Grains

The most extensive series of Government programs in Canadian agriculture are those designed to assist Prairie grain producers. The Canadian Wheat Board (CWB) controls grain marketing on behalf of producers, and a large number of Government programs provide assistance in resource development, price maintenance, storage and transportation, and exports. The effects of some of the more important programs on grain production patterns are summarized below:

Policy	Effect of selected Government policies on grain production, Canada, 1960-70
CWB marketing quotas.	Encouraged grain acreage expansion, favored wheat over other grains, and encouraged an inefficient allocation of Prairie resources.
CWB restrictions on inter-Provincial Trade	Encouraged inefficient allocation of Prairie resources.
Temporary Wheat Reserves Act. . . .	Favored wheat over other grains and encouraged wheat production in times of surplus supply.
Prairie Grain Advance Payments Act.	Favored wheat over other grains, and encouraged grain production in times of surplus supply.
Feed freight assistance	Encouraged livestock production in eastern Canada and feedgrain production in the Prairies. Led to some inefficiency in resource allocation.

Government expenditures on the most important programs which assist Prairie grain farmers are shown in table 34. Note that the program with the largest expenditures, statutory grain freight rates, involves no direct Government payments. These Government programs have had an important effect on the returns of Prairie grain farmers, particularly wheat farmers. Estimates of the benefits accuring to each bushel of

Table 34.--Cost of selected Government programs affecting Prairie grain producers, Canada, 1960-70 1/

Program	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970
	Can$1,000										
LIFT 2/	--	--	--	--	--	--	--	--	--	--	55,392
Initial payment guarantee: 3/											
Wheat	--	--	--	--	--	--	--	--	39,788	--	n.a.
Barley	--	--	--	--	--	--	--	--	9,835	--	n.a.
Oats	--	--	--	--	--	--	--	--	1,142	--	n.a.
Total	--	--	--	--	--	--	--	--	50,766	--	n.a.
Two-price wheat	--	--	--	--	--	--	--	--	--	4/9,287	n.a.
Temporary Wheat Reserves Act 5/	50,431	47,974	28,897	44,934	28,568	40,926	24,294	34,980	55,879	71,330	62,800
Prairie Grain Advance Payments Act 6/	1,472	386	490	870	540	666	540	780	7/13,000	16,400	n.a.
Statutory grain freight rates 8/											
Wheat	95,000	73,000	114,000	136,000	126,000	137,000	152,000	109,000	102,000	99,000	n.a.
Coarse grains	22,000	15,000	28,000	25,000	20,000	26,000	27,000	21,000	21,000	34,000	n.a.
Total	117,000	88,000	142,000	161,000	146,000	163,000	179,000	130,000	123,000	133,000	n.a.
Feed freight assistance 9/											
Wheat	4,194	3,062	2,646	3,428	3,000	4,085	3,914	2,752	2,771	5,573	n.a.
Coarse grains	15,324	12,259	12,925	16,017	14,864	15,668	16,686	17,038	16,641	15,821	n.a.
Total	19,518	15,591	15,571	19,445	17,864	19,753	20,600	19,790	19,412	21,394	n.a.

-- means zero or less than one-half a unit.
n.a. means not available.

1/ Years beginning Aug. 1.
2/ Lower Inventory for Tomorrow, a 1970 wheat stock reduction program (246, Mar. 4, 1971).
3/ The last Federal payment previous to those reported in the table was Can$2.2 million paid to 1956-57 oats pool (222, 1968/69, pp. 16-21).
4/ In 1969/70, 62,327,000 bushels of wheat were delivered to domestic flour mills for domestic consumption (total deliveries of 89,290,000 less 29,963,000 bushels wheat equivalent of flour exported.) Under the assumption that the average grade delivered was No. 2 Northern, the guaranteed price should have been Can$1.925 a bushel. This is Can$0.149 more than the average of weekly quotes (213) Thunder Bay for No. 2 Northern (Can$1.776). So the total subsidy is calculated: Can$0.149 x 62,327,000 = Can$9,287,000.
5/ (49, p. 73; 79, p. 240; 221, 1969/70, p. 55).
6/ Total interest cost and payment defaulted (49, p. 75; 60; 246, July 30, 1971).
7/ Estimate (60, p. 20).
8/ Does not include benefits to oilseed producers. Freight rates are set by Federal statute, but no direct payments are made by the Government to the railroads to offset these low rates. Walker (180) estimated it would cost Can$122 million to Can$219 million a year in extra freight rates to match comparable U.S. rates. Estimates of the benefits accruing to producers are based on the following assumptions: (1) Without the statutory limitation, freight rates would be 3 times the present rates; (2) the average rate paid on grain moving from Prairie points to terminals is Can$0.22 per cwt. (Saskatoon to Thunder Bay or Wainwright, Alta., to Pacific Coast); (3) the benefit to producers would be 2 times the statutory rate of Can$0.44 per cwt.; and (4) statutory rates apply to 91 percent of wheat marketed and 85 percent of coarse grains marketed, thus reducing average wheat benefit to Can$0.4004 per cwt., marketed, and average coarse grain benefit to Can$0.374 per cwt., marketed. Marketings are reported in (221).
9/ About half of expenditures benefit Prairie grain producers and half benefit eastern and British Columbia livestock producers. Allocation between wheat and coarse grains assumes expenditures per ton of grain shipped are the same for wheat as for coarse grains (52).

Sources: Listed with footnotes.

Prairie wheat entering the marketing system (shown in table 35) range from 28 cents (Canadian) to 47 cents a bushel for 1960-69.

Table 35.--Selected Government policies affecting wheat producers in the Prairie Provinces, by cost per bushel of wheat marketed, 1/ 1960-69 2/

Policy	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969
	Canadian cents per bushel									
Initial payment guarantee. . .	--	--	--	--	--	--	--	--	9.4	--
Two-price wheat.	--	--	--	--	--	--	--	--	--	2.2
Temporary Wheat Reserves Act .	12.7	15.7	6.1	7.9	5.4	7.2	3.8	7.7	13.2	17.3
Statutory freight rates 3/ . . .	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0
Feed freight assistance . .	0.5	0.5	0.3	0.3	0.3	0.4	0.3	0.3	0.3	0.7
Total.	37.2	40.2	30.4	32.2	29.7	31.6	28.1	32.0	46.9	44.2

1/ With the exception of statutory freight rates, per bushel costs are calculated by dividing total cost of the program (see table 34) by the number of bushels of wheat marketed (reported in 221, 1969/70).
2/ Years beginning Aug. 1.
3/ Estimated benefits per bushel marketed as calculated in table 34.

Sources: Calculated from table 34 and (221).

The Canadian Wheat Board and other important assistance and subsidy programs are discussed below.

Canadian Wheat Board.--The Canadian Wheat Board, a corporation partly controlled by the Government (crown corporation), has monopoly control over the marketing of wheat, barley, and oats produced in the three Prairie Provinces and the Peace River area of British Columbia. The CWB owns no marketing facilities, but contracts with the owners of facilities for their use. It controls the delivery of grain and oilseeds to country elevators and their transport to terminal points (Thunder Bay, Pacific Coast, and Churchill). The Board pays producers an initial payment for grain delivered to it, pools each grain, and returns the profits from each pool to the producers. The CWB administers certain Government programs (for example, the Prairie Grain Advance Payments Act and Temporary Wheat Reserves Act) and controls all imports and inter-Provincial trade (among and from the Prairie Provinces) in wheat, barley, and oats.

Wheat Board controls over marketing quotas, producer price for grain, and grain trade are discussed below.

The market quota system is designed to give all farmers an equal opportunity to deliver grain and to channel desired types of grain to the market. At the beginning of each marketing year (Aug. 1), the Canadian Wheat Board issues permit books to all Prairie producers who wish to market grain. In 1969/70, 190,004 permit books were issued. The book lists where the holder may deliver grain and the amount of land sown to various crops and summer fallow on his farm.

Before 1970/71, the quota system operated as follows: A "unit quota," which was declared at the beginning of each marketing year, permitted every producer to deliver an equal amount of grain (wheat, barley, oats, or rye) regardless of farm size.

"General quotas" were declared throughout the year as elevator space became available. Each quota announcement allowed producers to deliver 1 bushel of grain per specified acre (specified acreage equals that sown to wheat, barley, oats, rye, and eligible forage crops and that in summer fallow). Because the general quotas were based on acreage, they favored larger, extensively operated farms and high unit value grains--that is, wheat.

In the 1970/71 marketing year, the quota system was adjusted to meet the special circumstances of the Lower Inventory for Tomorrow (LIFT) wheat acreage reduction program. Entitlement to deliver wheat was based on acreage of summer fallow, any increase in perennial forage, and on acreage seeded to crops other than grains, oilseeds, and forage.

The 1971-72 delivery quota system is based on total acreage seeded to grains, oilseeds, miscellaneous crops, summer fallow, and forage. For grain delivery purposes, producers are free to assign this acreage to the various crops in any way they wish, regardless of what they have actually sown. This will give producers an opportunity to dispose of farm-stored grain.

The system of grain delivery quotas has had three major effects on Prairie grain production patterns. First, it has induced acreage expansion at the expense of more intensive yield-increasing inputs. Since quotas were based on acreage, producers with high yields per acre were unable to deliver more wheat than producers with low yields during times of restricted quotas (much of the time) (10, p. 29; 49, p. 76; 178, p. 87). Second, the quota system encouraged delivery of wheat over feed grains. The higher initial payment for wheat (see below) encouraged producers to deliver higher valued grains and grades first, without regard for the current market demand for grain (62, p. 65; 49, p. 76). Third, the quota system had a perverse effect on the allocation of Prairie resources because quotas for all grains were equitably distributed throughout the Prairie grain-growing area. Producers in areas where wheat had a comparative advantage over other areas were penalized because their wheat-delivery quotas were no larger than in areas more favorable to feed grain production. Thus, mixed grain farming was encouraged in all areas, regardless of comparative advantage (9, pp. 10-11).

Producer prices for wheat, barley, or oats delivered to elevators consist of an "initial payment" for the type and grade of grain delivered plus a certificate entitling them to any eventual "final payment." Charges for handling and transport to Thunder Bay or Vancover, whichever is cheaper, are deducted from the initial payment. Initial payment levels are established every crop year and may be changed from year to year depending on market prices (see table 38, p. 75). The grain delivered is pooled (new pools--one for each grain--are set up every year) and the profits from each pool are distributed equitably among the producers in the form of final payments. If any pool loses money, the deficit is covered by the Federal Government. Thus, the initial payment is a floor price for wheat, barley, and oats. The initial payments, however, are set relatively low and fluctuate somewhat along with world prices (see table 38, p. 75). The pools rarely close with a deficit, but in 1968/69 all three pools did, losing a total of Can$51 million (table 34). The Government guarantee on the wheat pool amounted to a subsidy of 9.4 cents (Canadian) for every bushel of wheat marketed (table 35). The last deficit before 1968/69 was a loss of Can$2.2 million on the 1956/57 oats pool.

Rye, flaxseed, and rapeseed are not sold to the Wheat Board. Elevator operators purchase these commodities from producers for the account of the grain company or cooperative which owns the elevator. Producers are paid the full, current market price at the time of delivery. The Government has proposed legislation which would enable it to place these grains under Wheat Board control, but no actual transfer of control is currently contemplated.

The Canadian Wheat Board's control over trade covers inter-Provincial movement of Prairie wheat, barley, and oats and imports of all wheat, barley, and oats.

With the exception of grain sold for consumption within the Province where produced, all Prairie wheat, barley, and oats must be sold to agents of the CWB within the confines of the quota delivery system (see above). An artificial separation among Provincial and national grain markets results when grain supplies exceed delivery quota opportunities (a situation prevailing much of the time) and when intra-Provincial (nonquota) grain sales are made at prices below those set by the Wheat Board. Thus, each of the Prairie Provinces has an independent market for nonquota grain and must produce a substantial portion of its own feed grain supply to assure a supply of cheap grain for its livestock industry. The result has been an uneconomic allocation of Prairie resources, because individual Provinces have been prevented from specializing in the form of production to which they are best suited (112, pp. 64-65; 117, p. 41; 188, p. 14).

It is necessary to obtain a license issued by the Canadian Wheat Board to import wheat, barley, or oats into Canada. No licenses have been issued in recent years.

Several other Government programs in addition to the Wheat Board have affected grain production patterns since 1960. Those discussed here are the 1970 LIFT program, two-price wheat, the Temporary Wheat Reserves Act, the Prairie Grain Advance Payments Act, statutory freight rates, and feed freight assistance.

LIFT.--Lower Inventory for Tomorrow was a special 1-year (1970) program designed to reduce excessive wheat stocks. Producers who diverted wheat acreage to summer fallow received Can$6 per acre diverted, and those who switched to perennial forage received Can$10 per acre. Approximately 94,000 producers participated and total payments made by the Government were estimated at Can$55.4 million--Can$47 million for summer fallow acreage increases and Can$8.4 million for forage acreage increases (table 34). The program was one of several factors that caused Prairie wheat acreage to decline by 51 percent in 1970 (246, Mar. 4, 1971; 243, July 5, 1971).

Two-price wheat.--Since the 1969/70 marketing year, all domestic sales of wheat for human consumption have had a minimum price of Can$1.955 a bushel, basis No. 1 Northern at Thunder Bay. The export price for No. 1 Northern was below this level throughout the 1969 season. Thus, Canadian wheat consumers subsidized Prairie producers for about Can$9.3 million or 2 cents per bushel marketed (tables 34 and 35). In 1972 this minimum price was raised to Can$3.00 for No. 1 Canadian Western Red Spring Wheat. The Federal Government will make a direct payment to the Wheat Board for the difference between the old minimum and the new Can$3.00 minimum.

Temporary Wheat Reserves Act.--The Temporary Wheat Reserves Act provides for Government payment of storage costs on all CWB-held wheat supplies in excess of 178 million bushels. Since the policy was initiated in 1956, carryover stocks have never been below 331 million bushels and have been as high as 480 million bushels (Aug. 1, 1970). Through the 1960's, payments averaged Can$43 million a year or 9.7 cents per bushel of wheat marketed (tables 34 and 35) (49, pp. 72-73; 79, p. 232).

This policy had two major effects upon Prairie grain production patterns. First, since the subsidy applied only to wheat, it favored the production of wheat over other grains. Second, by absorbing the producers' cost of surplus wheat storage, it insulated them from market forces and encouraged excess wheat production during times of low market demand (49, pp. 72-73).

Prairie Grain Advance Payments Act.--When country elevators are filled and Prairie farmers are unable to make grain deliveries, they can obtain an advance, partial payment for some of their farm-stored wheat, barley, or oats through terms of the Prairie

Grain Advance Payments Act. CWB permit holders are eligible for interest-free advance payments up to a total of Can$6,000 (Can$3,000 before 1968) per marketing year. Repayment is made by deducting the advance from subsequent grain deliveries. Statistics on advance payments made during 1957-69 are shown in table 36. The total cost of the program (for interest and defaulted payments) to the Federal Government ranged from Can$386,000 to Can$1.47 million a year before 1968, but costs in 1968 and 1969 soared to Can$13 million and Can$16 million because of larger advances, higher interest rates, and large outstanding advances (table 34).

Table 36. Advances paid under Prairie Grain Advance Payments Act, average 1957-67, annual 1968-69 1/

Item	Unit	Average 1957-67	1968	1969
Applications.	Number	46,544	2/85,000	n.a.
Total amount advanced	Can$1 million	39.8	151.9	272.8
Average amount advanced	Canadian dollars	854	1,786	n.a.

1/ Years beginning Aug. 1.
2/ Applications actually received were 113,491, but more than 1 application was filed by many applicants because of changes in the law in Nov. 1968. The 85,000 figure is an estimate of the real number of applicants.

Sources: (49; 221, 1969/70, p. 68).

Per-bushel advance payments for wheat were higher than for barley or oats. The Advance Payments Act thus affected Prairie grain production patterns in two ways: By encouraging continued high production in times of surplus grain supplies and by favoring wheat over other grains. A 1971 amendment to the act removed the wheat delivery bias and gave the Government the authority to extend the act to rye, flaxseed, or rapeseed in the event these commodities should be placed under Wheat Board Control (49, pp. 74-76; 60; 79, p. 117; 246, Apr. 29, 1971).

Statutory grain freight rates.--Statutory grain freight rates consist of a number of laws and orders which established maximum allowable freight rates for western grain. The 1897 Crow's Nest Pass Agreement between the Canadian Government and the Canadian Pacific Railroad established rates for the movement of Prairie grain to Lakehead. In 1927, these rates were set by statute as the maximum allowable on all railroad lines for all grain shipped to Lakehead and for grain shipped to the Pacific Coast and Churchill for export. These freight rates, called Statutory or Crow's Nest Pass Rates, are still in effect.

Prairie grain producers profit from these rates, which are now well below those charged on U.S. or Canadian railroads for shipping goods other than grain. In 1965, freight rates on U.S. railroads for grain shipped to Duluth, Minn., were 3.3 to 4.1 times as great as the Canadian statutory rates on grain shipped comparable distances to Thunder Bay, and U.S. rates to Seattle, Wash., were 2.5 to 3.9 times as great as Canadian statutory rates to Vancouver. In 1969, nonstatutory grain freight rates in western Canada (shipments to Vancouver for domestic use) were 3.6 to 4.2 times greater than the statutory rates.

The value of benefits accruing to Prairie grain producers from the statutory rates is the difference between total freight rates presently paid and what the rates would be without the statutory limitations. Under the assumption that the latter would be three times the present rates, and that the average rate now paid is 22 cents (Canadian) per cwt. (Can$0.134 per bushel or Can$4.85 per ton), the benefits accruing to Prairie grain producers ranged between Can$88 and Can$179 million per year during the 1960's (table 34). This compares to an estimate of Can$122 million to Can$219 million made by a Canadian economist in 1969 (180, pp. 75-76). The benefits to wheat producers alone are estimated to average 24 cents (Canadian) for every bushel marketed (table 35)

No subsidy is paid to the railroads for maintaining the statutory rates on grain transport, but they do receive Government subsidies for operating unprofitable branch lines and passenger trains. The losses incurred by the imposition of the statutory grain freight rates are most likely covered, at least in part, by these subsidies and by cross-subsidization within the railroads' rate structures (65, pp. 100-111; 135, pp. 47-54; 165, p. 22; 220).

Feed freight assistance.--The objective of the feed freight assistance policy is to equalize the cost of feed grains throughout Canada. This is achieved by subsidizing the freight costs on Prairie feed grains shipped from Thunder Bay to eastern Canada and from Prairie points to British Columbia. (Shipments of feed wheat and corn from Ontario to Quebec and the Atlantic Provinces are also subsidized but account for a relatively insignificant proportion of total shipments.) The subsidy covers almost the entire cost of transportation.

An average of 2.5 million short tons of grain are shipped annually under the provisions of the program. Lower grain prices caused shipments to increase to 3 million tons in 1969/70. In 1965-69, 46 percent of freight-assisted feed grain shipments were destined for Quebec, 31 percent for Ontario, 12 percent for the Atlantic Provinces, and 11 percent for British Columbia. During this period, barley accounted for 34 percent of shipments, oats 22 percent, wheat 19 percent, and mill feeds 20 percent. The total cost of the feed freight assistance program averages around Can$19 million annually (table 34). A 1967 study estimated that the benefits of the freight subsidy are divided 50-50 between Prairie grain farmers and livestock and poultry feeders in eastern Canada and British Columbia. 31/ The feed freight assistance program lowered the cost of feed grains to livestock and poultry producers in the recipient areas and increased the market for Prairie feed grains. This encouraged feed grain production in the Prairie Provinces and livestock production in eastern Canada and British Columbia. As a result, it has caused some inefficiency in the allocation of resources, by transferring some livestock production from the Prairies to the East, and some grain production from the East to the Prairies. The amount of inefficiency caused by this policy is debatable (49, pp. 76-78; 78; 79, pp. 233-237; 112; 117; 184; 188).

Ontario Corn

There are only two important policies affecting corn producers in Ontario: the tariff on corn imports and the feed freight assistance program. There is no Government- or producer-controlled agency to regulate marketing.

The Canadian tariff on corn imports is 8 cents (Canadian) per bushel. The tariff sets a floor price for Canadian-grown corn which is at least 8 cents per bushel, plus transport costs, above the price prevailing in the United States.

Shipments of Ontario corn and wheat to Quebec and the Atlantic Provinces are subsidized under the feed freight assistance program, but since Ontario is a feed-deficit

31/ Cited in (117, p. 26).

area, relatively little grain is shipped out of the Province. In 1969/70, only 681,000 bushels of Ontario corn were shipped east under the freight assistance program.

Livestock

Among the major institutional factors affecting livestock production are the marketing system, the meat grading system, the Agricultural Stabilization Board, the Prairie Farm Rehabilitation Administration (PFRA), the use of public lands, feed freight assistance, a new forage incentive program, and various Provincial government policies. These factors are not nearly as important as those affecting grain production. However, the relative importance of programs designed to assist Prairie cattle ranchers has grown in recent years, and the hog-marketing system has become increasingly institutionalized since 1960. The cost of some important Government programs affecting cattle and hog producers is summarized in table 37.

Marketing system.--Canadian farmers market cattle and hogs through a variety of outlets. They have a choice of marketing through one of the 10 public stockyards (terminal markets); through country auctions; directly to a packing plant or a packing plant agent; to cattle dealers; or through producer-controlled marketing organizations such as hog-marketing boards, cooperatives, or commission agents. There is a minimum of Government control of cattle marketing--most of it concerned with the regulation of market facilities, especially the public stockyards and country auctions. However, hog marketing in several Provinces has recently come under the jurisdiction of producer-controlled marketing boards.

Most slaughter cattle in Canada are marketed through public stockyards or sold directly to packing plants. The trend is for an increasing proportion of marketings directly to packers. Only 10 percent of commercial hog marketings are through public stockyards--the rest move directly to packers. In five Provinces, including Alberta, Manitoba, and Ontario, producer-controlled marketing boards control the sale of hogs to packing plants. Country auctions have become increasingly important as markets for feeder and replacement cattle and weanling pigs.

Meat grading.--The Canadian beef-grading system consists of three major grades for retail cuts--Choice, Good, and Standard (red, blue, and brown)--and several grades for manufacturing beef. A new grading system that would be a better indicator of lean weight is now being discussed and will probably be introduced by 1975.

A new index grading system based on backfat measurement and warm dressed weight was introduced for hogs on December 31, 1968. In the new system, index 100 equals the norm upon which the price is based, index 88 equals the lowest possible grade, and index 112 equals the highest possible grade. Producer price is the index number times price.

Under the old hog-grading system, the Federal Government paid quality premiums for the highest grades of hogs. Between 1960 and 1970, when the program was phased out, Can$5.4 million to Can$10 million was paid out annually for quality premiums (table 37). The new hog-grading system is designed to encourage production of high-quality animals through the normal pricing procedure. Several Provinces, however, continue their own hog quality premium programs (79, pp. 13, 17, 33, 34; 242, Mar. 11, 1971; 249, Apr. 15, 1971).

Agricultural Stabilization Board.--The board was established in 1958 for the purpose of stabilizing farm prices of agricultural products. The Agricultural Stabilization Act designated nine commodities--cattle, hogs, sheep, eggs, butter, cheese, and wheat, barley, and oats from outside CWB jurisdiction--whose prices are to be mandatorily maintained at a level not less than 80 percent of the average of the preceding 10 years.

Table 37.--Cost of selected Government programs affecting cattle and hog producers, Canada, 1960-69

Program	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969
	Can$1,000									
PFRA, net expenditures 1/.	20,111	27,535	30,182	25,347	28,803	31,350	23,322	19,967	17,092	13,303
Feed freight assistance 2/	19,518	15,591	15,571	19,445	17,864	19,753	20,600	19,790	19,412	21,394
Agricultural Stabilization Act 3/	29,244	2,020	7,529	6,768	80	401	51	55	3	--
Hog quality premiums:										
Federal 4/	6,586	7,056	5,445	7,479	8,307	8,239	8,872	9,994	n.a.	n.a.
Quebec 5/.	--	--	--	--	--	646	1,123	n.a.	n.a.	n.a.

-- means zero or less than one-half a unit.
n.a. means not available.

1/ Prairie Farm Rehabilitation Administration. Years beginning Apr. 1. Benefits accrue principally to Prairie cattle producers. Calculated from (228).

2/ Years beginning Aug. 1. About half of expenditures benefit Prairie grain producers and half benefit eastern and British Columbia livestock producers (52).

3/ Years beginning Apr. 1. Expenditures represent net losses from purchases of surplus pork products between 1958 and 1960 (5; 79, p. 214).

4/ Years beginning Apr. 1. Program discontinued Dec. 31, 1970 (79, p. 5).

5/ Years beginning Apr. 1 (3; 79, p. 33).

Between 1958 and 1970, over 80 percent of price-support expenditures were for dairy products. The expenditures on hogs shown in table 37 are part of a total of Can$74 million spent since 1958 as the result of CWB purchases of over 300 million pounds of pork products between 1958 and 1960. These pork supplies were disposed of mostly through exports at concessional prices. No expenditures for the stabilization of cattle prices have been necessary (5; 79, pp. 209-214, 226-227).

Prairie Farm Rehabilitation Administration.--The PFRA was established during the 1930's to provide for the restoration of drought-afflicted and eroded-soil areas in the Prairie Provinces. The Administration has done much to develop submarginal land in the Prairies (mainly in arid areas) for livestock grazing. In 1969/70, PFRA net expenditures, which have been declining since 1966, amounted to Can$13 million (table 37). Over two-thirds of this amount was allocated to large-scale irrigation and land reclamation projects. Most of this was spent in Saskatchewan and Alberta. Regular budget expenditures (excludes the large-scale projects) are more concentrated in Saskatchewan, which accounts for over two-thirds of these expenditures (30; 79, pp. 64-68; 228). The PFRA also administers a community pasture program, which is discussed below.

Publicly owned grazing lands.--The Government assists operators of cow-calf enterprises in western Canada by leasing public lands for grazing at rates below market values and by operating community pastures.

Provincial governments lease over 7 million acres of grazing land to individual ranchers and grazing associations in the Prairies and British Columbia. Over 12,000 operators grazing about 400,000 head of cattle benefit from the use of this low-cost grazing land. A 1965 survey in Alberta determined that rental rates on publicly owned grazing land averaged only 56 percent of those on privately owned land. In addition, the leases obtained on public lands were longer and more secure.

Community pastures are directed mainly at assisting small-scale operators. There are over 3.5 million acres of community pastures in the three Prairie Provinces, most of which are in Saskatchewan. In 1969, the PFRA operated over 2.4 million acres of these pastures, which served over 6,000 patrons with 186,000 head of cattle and calves. Other community pastures, covering approximately 1.2 million acres, are administered by the Provinces, municipalities, and cooperative associations. In addition to grazing, the program for community pastures provides supervision and management services (30, pp. 58-61; 49, p. 166; 79, pp. 64-66; 105; 106; 109; 123, p. 9; 249, June 17, 1971).

Feed freight assistance.--This program benefits livestock and poultry feeders in eastern Canada and British Columbia by lowering the delivered cost of Prairie feed grains. The program (described on p. 70) pays out an average of Can$19 million a year in transport subsidies, about half of which accrue to eastern and British Columbia feeders.

Forage incentive program.--The 1970 wheat acreage reduction program included incentives for increasing perennial forage acreage (p. 68). Total 1970 forage-related LIFT payments were Can$8.4 million. A 3-year program that began in 1971 continues to offer an incentive to Prairie farmers for transferring cropland into forage production. Under the terms of the new program, CWB permit holders will be offered a payment of Can$10 for every acre switched from crops or summer fallow into perennial forage. Unlike the LIFT program payment, the incentive payment will not be tied to a reduction in total grain or oilseed acreage. The program is voluntary and will be limited to 3 years or 4 million acres, whichever is reached first. Maximum total cost over the 3-year period would be Can$40 million (246, Feb. 25 and Mar. 4, 1971).

Provincial policies.--The governments of Saskatchewan and Manitoba have recently initiated special programs for promoting agricultural diversification. These programs

involve loan guarantees, grants, and other incentives aimed at increasing the importanc of livestock production, especially cow-calf operations (49, p. 165; 246, Mar. 4, 1971; 244, June 1970).

V. PRICES AND SUPPLY RESPONSE

The basic objective of this chapter is to determine which price variables Canadian farmers use to guide their production decisions. To reach this objective, it was necessary to explore the relationship that has existed between price levels and production. The examination of supply response is preceded by a discussion of price trends.

Price Trends

Wheat

Since 1955, price trends for wheat at the producer level have been generally upward (table 38). Initial payments to producers have decreased only once--in 1969. Because of year-to-year fluctuations in final payments, the final realized price has been quite variable, but it has tended to increase. Wholesale and U.K. import prices have not followed the producer price trends. The average Canadian Wheat Board selling quotation tended to decrease during the first half of the 1955-70 period, but tended to be higher thereafter. U.K. import prices followed the same pattern.

Feed Grains

Barley.--Canadian producer prices for barley, like those for wheat, consist of an initial payment, a final payment, and, in some years, one or more interim payments. The final realized price of barley and the average CWB selling price appear to have more of a tendency to deviate around their respective means than to follow either an upward or a downward trend (table 39).

Oats.--Producer prices for oats are set in the same manner as producer prices for barley. Producer and selling prices since 1955 are shown in table 39. The average selling quotation of the CWB during 1955-70 followed the same general pattern as the final producer price--that is, down from the original level and slightly higher for 1966 and 1967.

Corn.--Canadian corn does not have a minimum price support. Producer prices, as reflected by terminal market (Chatham) prices, varied considerably during 1955-70. Table 40 indicates that the price of No. 2 Yellow Corn varied from a high of Can$1.53 a bushel in 1966/67 to a low of Can$1.19 in 1959/60. No definite trend is apparent. Average farm value of Ontario corn has shown a quite definite uptrend; however, much of the uptrend may be due to quality improvement rather than to higher prices per se.

Beef

Feeders.--Canadian feeder steer prices have shown a definite upward trend. During 1955-70, feeder prices increased from Can$16.55 to Can $32.40 (table 41). In only 2 of the 16 years was the price more than Can$1 per cwt. lower than it had been the previous year. Feeder steer prices in the United States have moved in the same general pattern as those in Canada.

Table 38.--Prices and margins for No. 2 Manitoba Northern Wheat, Canada, 1955-71

Year 1/	Initial payment 2/	Final realized price (FRP) 2/	Average CWB selling quotation 3/	U.K. import price 4/	Margins		
					CWB quote over FRP	U.K. price over CWB quote	U.K. price over FRP
	Canadian dollars per bushel						
1955. . .	1.36	1.61	1.69	2.19	0.08	0.50	0.58
1956. . .	1.36	1.58	1.70	2.26	.12	.56	.68
1957. . .	1.36	1.55	1.65	2.21	.10	.56	.66
1958. . .	1.36	1.59	1.58	2.03	-.01	.45	.44
1959. . .	1.36	1.56	1.63	2.00	.07	.37	.42
1960. . .	1.36	1.55	1.63	1.97	.08	.34	.42
1961. . .	1.36	1.76	1.63	2.01	-.13	.38	.25
1962. . .	1.36	1.90	1.88	2.21	-.02	.33	.31
1963. . .	1.46	1.85	1.95	2.25	.10	.30	.40
1964. . .	1.46	1.94	2.00	2.37	.06	.37	.43
1965. . .	1.46	1.85	1.95	2.35	.10	.40	.50
1966. . .	1.46	1.97	1.97	2.40	--	.43	.43
1967. . .	1.46	1.96	2.09	2.50	.13	.41	.54
1968. . .	1.66	1.79	1.93	2.35	.14	.42	.56
1969. . .	1.66	1.66	1.90	2.30	.24	.40	.64
1970. . .	1.46	1.55	1.78	2.24	.23	.46	.69
1971. . .	1.46	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

-- means zero or less than one-half a unit.
n.a. means not available.

1/ Years beginning Aug. 1.
2/ Basis--Thunder Bay.
3/ Average of daily Canadian Wheat Board daily fixed prices, basis in store Thunder Bay.
4/ Basis--c.i.f. St.Lawrence ports. End-of-calendar-year exchange rates used to convert US$ to Canadian $.

Sources: (220; 226).

Table 39.--Prices and margins for No. 3 Canadian Western 6-row Barley and No. 2 Canadian Western Oats, 1955-71

Year 1/	Barley					Oats			
	Initial payment 2/	Final realized price (FRP) 2/	Average CWB selling price 3/	Margin CWB over FRP	U.K. import price 4/	Initial payment 2/	Final realized price 2/	Average CWB selling price 3/	Margin CWB over FRP
	Canadian dollars per bushel								
1955. . .	0.96	1.10	1.23	0.13	1.39	0.65	0.81	0.91	0.10
1956. . .	.96	1.09	1.15	.06	1.52	.65	.80	.84	.04
1957. . .	.96	1.02	1.16	.14	1.52	.65	.65	.81	.16
1958. . .	.96	1.03	1.11	.08	1.31	.60	.67	.77	.10
1959. . .	.96	1.01	1.10	.09	1.22	.60	.70	.78	.08
1960. . .	.96	.98	1.08	.10	1.20	.60	.77	.82	.05
1961. . .	.96	1.04	1.08	.04	1.26	.60	.74	.81	.07
1962. . .	.96	1.28	1.44	.16	1.35	.60	.77	.96	.19
1963. . .	.96	1.13	1.31	.18	1.57	.60	.72	.82	.10
1964. . .	.96	1.18	1.24	.06	1.44	.60	.69	.79	.10
1965. . .	.96	1.26	1.33	.07	1.48	.60	.77	.83	.06
1966. . .	.96	1.29	1.38	.09	1.59	.60	.84	.90	.06
1967. . .	.96	1.29	1.37	.08	1.68	.60	.83	.93	.10
1968. . .	1.06	1.10	1.31	.21	1.55	.65	.83	.95	.12
1969. . .	1.06	1.06	1.20	.14	1.31	.65	.65	.85	.20
1970. . .	.91	.94	1.12	.18	1.26	.60	.70	.73	.03
1971. . .	.91	n.a.	n.a.	n.a.	n.a.	.60	n.a.	n.a.	n.a.

n.a. means not available.

1/ Years beginning Aug. 1.
2/ Basis--Thunder Bay.
3/ Average of daily Winnipeg Grain Exchange daily closing cash quotations, basis in store Thunder Bay.
4/ No. 2 Feed Barley, nearest forward shipping point, c.i.f.

Sources: (220; 223).

Table 40.--Prices and margins for Ontario corn, 1955-71

Year 1/	Chatham 2/	Chicago 3/	Margin, Chatham over Chicago	Average farm value 4/
	Canadian dollars per bushel			
1955. .	1.44	1.47	-0.03	
1956. .	1.24	1.24	.00	1.06
1957. .	1.32	1.27	.05	1.20
1958. .	1.20	1.18	.02	1.18
1959. .	1.25	1.21	.04	1.21
1960. .	1.19	1.11	.08	1.16
1961. .	1.23	1.10	.13	1.23
1962. .	1.29	1.16	.13	1.21
1963. .	1.37	1.28	.09	1.28
1964. .	1.42	1.30	.12	1.37
1965. .	1.40	1.35	.05	1.30
1966. .	1.45	1.37	.08	1.30
1967. .	1.53	1.47	.06	1.47
1968. .	1.31	1.21	.10	1.25
1969. .	1.30	1.24	.06	1.24
1970. .	1.37	1.33	.04	1.28
1971. .	n.a.	n.a.	n.a.	5/1.29

n.a. means not available. 1/ Years beginning Aug. 1. 2/ No. 2 Yellow Corn f.o.b. Chatham, Ont. 3/ No. 3 Yellow Corn f.o.b. Chicago. Converted at end-of-calendar-year exchange rates. 4/ Includes all grades of corn. 5/ Preliminary.

Sources: (220; 227).

Slaughter steers.--The increase in Canadian slaughter steer prices during 1955-70 was not as large as the increase in feeder steer prices. Slaughter steer prices ranged from a low of Can$18.80 per cwt. in 1956 to a high of Can$30.40 in 1970 (table 41). The price of U.S. slaughter steers increased less rapidly than the price of Canadian steers.

Pork

The all-Canada and Toronto prices of grade B slaughter hogs (index-100 grade beginning in 1969) trended upward through 1955-70, although 1970 prices declined markedly from 1969 prices (table 42). The increase in Chicago prices was a little greater than the increases in Canadian prices. None of the price trends have been smooth, with changes of 10 percent from year to year being fairly common in both Canadian and U.S. markets. During 1955-70, the all-Canada price of pork ranged from Can$0.50 to Can$2.30 below the Toronto price, with the price differential tending to decrease in the more recent years.

Table 41.--Beef cattle, selected production and price statistics, Canada, 1955-70

Year	Beef production			Prices				
	Animals slaughtered	Average weight 1/	Total weight 1/	Cows 2/	Canadian feeders 3/	U.S. feeders 4/	Canadian slaughter steers 5/	U.S. slaughter steers 6/
	Thousands	Pounds	Mil. lbs.	Canadian dollars per cwt.				
1955	2,271	486	1,102	11.85	16.55	18.58	19.60	23.16
1956	2,421	484	1,173	10.95	16.10	16.67	18.80	22.30
1957	2,514	495	1,245	11.90	16.85	20.02	19.05	23.83
1958	2,438	501	1,220	16.60	21.90	24.64	22.90	27.42
1959	2,261	510	1,153	17.05	23.08	24.40	25.10	27.83
1960	2,471	512	1,266	15.50	19.90	22.84	22.65	26.24
1961	2,544	519	1,320	15.50	20.50	24.30	22.75	24.65
1962	2,572	518	1,333	17.20	24.20	26.44	25.75	27.67
1963	2,679	531	1,423	17.10	23.25	24.81	23.65	25.94
1964	2,965	530	1,573	15.40	20.70	21.26	22.70	24.98
1965	3,367	519	1,750	14,80	21.95	24.19	24.00	28.55
1966	3,291	534	1,757	18.85	24.90	27.54	25.85	28.44
1967	3,229	538	1,739	19.95	26.40	26.67	27.65	28.06
1968	3,446	547	1,855	19.55	26.40	27.77	26.90	30.19
1969	3,254	554	1,801	23.95	31.25	31.44	29.35	30.42
1970	3,221	561	1,806	23.45	32.40	7/30.46	30.40	7/30.55

1/ Cold dressed weight.
2/ Good cows at Winnipeg.
3/ Good feeders at Calgary.
4/ All weights of feeder steers at Kansas City. Converted to Canadian dollars at end-of-year exchange rates.
5/ Good steers at Toronto.
6/ Choice steers weighing 1,100 to 1,300 pounds at Chicago. Converted to Canadian dollars at end-of-year exchange rates.
7/ Average price is understated because the Canadian dollar increased in value relative to the U.S. dollar in the last half of the year.

Sources: (208; 229; 230).

Table 42.--Hogs, selected production and price statistics, Canada, 1955-70

Year	Pork production			Prices			Hog-barley ratio 4/
	Animals slaughtered	Average weight 1/	Total weight 1/	All Canada 2/	Toronto 2/	Chicago 3/	
	Thousands	Pounds	Mil. lbs.	Canadian dollars per cwt.			
1955	6,932	128.2	887.8	23.00	25.05	21.15	17.3
1956	6,858	128.6	882.0	24.20	26.50	20.02	18.5
1957	6,295	130.0	818.4	28.70	30.05	23.69	25.5
1958	7,466	130.4	973.6	26.47	28.13	26.62	23.5
1959	9,662	128.1	1,237.7	21.99	23.80	19.05	18.6
1960	7,804	126.6	988.0	22.18	23.75	21.11	18.7
1961	7,598	128.5	975.4	25.40	27.30	23.51	18.6
1962	7,698	127.9	984.6	27.00	28.60	24.41	16.3
1963	7,622	128.7	981.0	26.15	26.80	22.60	17.3
1964	8,296	127.8	1,060.0	25.25	26.30	22.64	16.2
1965	7,932	126.9	1,006.5	31.00	32.40	31.17	19.1
1966	7,890	128.6	1,014.3	34.00	34.90	34.58	20.4
1967	9,162	129.0	1,181.5	28.55	29.10	28.99	17.5
1968	9,234	128.0	1,181.3	28.80	29.80	28.74	19.7
1969	8,730	130.0	1,134.5	5/35.20	5/35.70	35.19	28.0
1970	10,200	132.5	1,352.0	5/30.10	5/32.20	6/	21.3

1/ Cold trimmed weight.

2/ Dressed-weight basis, grade B hogs. Weighted average price for all public stockyards.

3/ Chicago prices are based on live weight, U.S. #1-3, 200 to 220 pounds. The dressed-weight basis price was calculated from the U.S. average dressing percentage.

4/ The hog-barley ratio is the number of bushels of No. 1 Feed Barley equal in value to 100 pounds (live weight) of grade B hog (index 100 in 1969 and 1970) with prices at Winnipeg.

5/ Index-100 hogs.

6/ Series discontinued.

Sources: (198; 208).

Supply Response to Price Changes

This section includes discussions of analyses made by other investigators and independent analysis done by the authors.

Wheat

Previous studies.--Although supply response to price in grains consists of an acreage component and a yield component, the discussion here is centered on the acreage component. Because of weather and diseases, Canadian wheat yields are extremely variable. As a consequence, major research is required to "normalize" wheat yields so that they reflect response to price changes rather than weather variations and the incidence of disease. One such effort, by G.D.V. Williams, indicated that most of the variation in wheat yields could be accounted for by meteorological variables (183).

Acreage response to price changes was estimated in a study of world demand prospects for wheat by Hutchison, Naive, and Tsu (98). The study, based on 1951-66 data, used various selections from seven variables to estimate four acreage-response equations. Only one of the four equations showed a significant statistical relationship between wheat acreage and price. In that case, the elasticity was estimated to be 0.51. As estimated, the equation was:

$$AW = 7.803 + 0.525\ AW\text{-}1 + 0.081\ PFW\text{-}1 + 0.047\ T$$

where:

AW = area seeded to wheat in millions of hectares
AW-1 = AW lagged 1 year
PFW-1 = farm price of wheat lagged 1 year
T = time with 1950 = 1

All coefficients were statistically significant at the 5-percent level. Two other equations indicated that barley and oats prices have only a weak influence on wheat acreage.

A more inclusive study of wheat acreage response was done by Andrew Schmitz (164). Using 1947-66 data, selected combinations of 12 variables, and traditional (1-year lag on prices) and distributed lag (multiyear weighted lags on prices) models, he estimated 25 equations which show wheat acreage response. 32/ Table 43 summarizes his price elasticity results. Barley prices were not significant and cattle prices had a positive rather than a negative sign. Schmitz argues that over the period analyzed, it is unlikely that livestock prices had any influence on wheat acreage. He concluded that an equation including wheat stocks, wheat and flax prices, and export sales will predict yearly wheat acreage response relatively accurately.

32/ Traditional models assume acreage is a function of the previous year's price. In contrast, distributed lag models assume acreage is a function of the previous year's price and the previous year's acreage. Since the previous year's acreage was also a function of previous price and acreage, the implication is that current acreage is a function of all past prices, with the most recent prices having the heaviest weights.

Table 43.--The range of price elasticities for Canadian wheat acreage estimated by traditional and distributed lag price models 1/

Model	Elasticities of wheat acreage response with respect to price changes			
	Wheat prices	Flax prices	Barley prices	Cattle prices
Traditional:				
High. . . .	.877	-.193	-.001	.132
Low	.491	-.080	2/	.058
	Wheat price elasticities			
Distributed lag:	Short run		Long run	
High. . . .	.754		1.30	
Low	.420		.62	

1/ The elasticities are computed at the mean values for prices and quantities. The ranges are based on 19 traditional models and 6 distributed lag models. 2/ Less than .0001.

Source: (164).

Current study.--Using the Hutchison and Schmitz studies as guides in the selection of important variables, we estimated 12 equations by regression techniques. Five of those equations, including pertinent statistics, are:

(1) WA = 2839.2 + 121.8 TP + 245.2 T
t = 5.16 2.86
R^2 = .89 E = .82

(2) WA = 20721.7 + 40.0 TP + 460.8 T - 9.30 TS
t = .94 3.72 2.19
R^2 = .93 E = .27

(3) WA = 5578.4 + 94.9 TP + 5.2 EX + 245.6 T
t = 3.05 1.28 2.94
R^2 = .91 E = .64

(4) WA = 21444.0 + 25.5 TP + 4.1 EX + 444.0 T - 8.6 TS
t = .58 1.12 3.60 2.01
R^2 .93 E = .17

(5) WA = 5610.2 + 91.2 TP + 5.4 EX + 245.6 T + 429.1 PB
t = 1.73 1.10 2.80 0.08
R^2 = .91 E = .61

Where:

WA = wheat area in thousands of acres
TP = producer price of wheat in Canadian cents per bushel, lagged 1 year
TS = wheat stocks in millions of bushels on August 1
EX = exports in millions of bushels, lagged 1 year
PB = producer price of barley in Canadian cents per bushel, lagged 1 year

T = trend value, 1955 = 1
R^2 = coefficient of determination
E = wheat price elasticity
t = "t" statistic

The regression runs were based on 1955-69 wheat area data.

Comparing these equations with those from the two studies discussed above discloses some differences and some similarities. One similarity is that not one of the equations indicates barley price had anything more than a very weak influence on wheat acreage. Although the Schmitz study indicated flaxseed price was a useful explanatory variable, tests using 1955-69 data did not indicate a significant relationship between it and wheat acreage.

A comparison of equations (1) and (2) indicates that wheat prices and stocks are so interrelated that the effect of stocks outweighs the effect or prices when both are used in the same equation. Ignoring the equations which include a stock variable leaves equations (1), (3), (5), whose supply elasticities range from .61 to .82. These are slightly higher than Hutchison's .51, but fall within the range of estimates obtained by Schmitz.

Barley and Oats

Previous studies.--At the time of this research, the only available study of the relationship between price levels and production of barley and oats was primarily concerned with world feed grain supply and demand rather than with Canada alone. The study, by Harold Bjarnason, used 1951-63 data to define price-production relationships (17). Bjarnason treats all feed grains--barley, oats, corn, and grain sorghum--as perfect substitutes so that he can aggregate the individual crops into one commodity. The price for each country is a weighted average of the prices of the individual crops. The best model explaining Canadian feed grain price relationships was:

$$H_t = 4825.5 + 72.7\ p^{fg}_{t-1} - 82.15\ P^{W}_{t-1} + 0.6282\ H_{t-1} - 67.83\ T$$

$$t = \quad 1.14 \qquad 0.75 \qquad 1.15 \qquad 0.88$$

$$R^2 = .65$$

Where:

H_t = hectares of feed grains, current year
H_{t-1} = hectares of feed grains, previous year
p^{fg}_{t-1} = previous year's feed grain price in US$ per ton
P^{W}_{t-1} = previous year's wheat price in US$ per ton
T = trend value

The equation gives an estimated short-run price elasticity of .45 and a long-run elasticity of 1.22. These estimates were based on price coefficients that are not significant at the 5-percent level.

Current study.--In expanding on the Bjarnason study, we ran approximately 12 regression equations each for barley area, oats area, and feed (barley plus oats) area. Two selections from each set of 12 equations are presented below:

$$(6)\quad BA = 9492.3 + 44.43\ BP - 0.33\ WA + 29.29\ BFS$$

$$t = \quad 0.80 \qquad 1.81 \qquad 1.93$$

$$R^2 = .44 \qquad E_B = .66$$

(7) BA = 1988.7 + 19.87 BP - 0.50 WA + 1.02 AU
t = .37 1.98 1.47
R^2 = .38 E_B = .29

(8) OA = 8052.0 + 34.18 OP - 213.4 T
t = 1.22 5.14
R^2 = .69 E_O = .29

(9) OA = 16219.8 - 0.28 WA + 19.52 OP - 16.35 OS
t = 3.35 .36 1.38
R^2 = .60 E_O = .16

(10) FA = 13866.3 + 28.0 BP - 0.83 WA + 145.8 OP + .64 AU
t = .61 3.61 2.22 .97
R^2 = .74 E_{FB} = .19 E_{FO} = .66

(11) FA = 23256.0 + 19.85 BP - .67 WA + 113.36 OP
t = .44 4.29 2.01
R^2 = .72 E_{FB} = .14 E_{FO} = .51

Where:

T = time = 1955-69, 1955 = 1
BA = barley area in thousands of acres
BP = final realized price of barley in Canadian cents per bushel, lagged 1 year
WA = wheat area in thousands of acres
BFS = farm stocks of barley in millions of bushels on August 1
AU = 1,000 grain-consuming animal units, based on June 1 livestock survey
OA = oats area in thousands of acres
OP = final realized price of oats in Canadian cents per bushel, lagged 1 year
OS = total stock of oats in millions of bushels on August 1
FA = feed area = barley area plus oats area, in thousands of acres
t = "t" statistic
R^2 = coefficient of determination
E_B = barley price elasticity
E_O = oats price elasticity
E_{FB} = feed grain/barley price elasticity
E_{OB} = feed grain/oats price elasticity

Equations (6) and (7), the barley area equations, indicate that barley acreage was influenced more by wheat area, farm barley stocks, and animal units than by price. These variables explain only a relatively low 38 to 44 percent of the variation in barley area. However, tests including additional variables did not result in a better fitting equation. The two equations give price elasticity estimates of 0.29 and 0.66, but neither price coefficient was significant at the 5-percent level. The lack of significance indicates that price, at least as defined, has only a minor part in determining area planted.

Equations (8) and (9), representing acreage response of oats, explained 69 and 60 percent, respectively, of the year-to-year variation in acreage planted to oats for grain. For oats, as for barley, the price coefficients were not significant at the 5-percent level. Estimates of price elasticity for the two equations were .29 and .16, respectively.

Equations (10) and (11), which represent the acreage response of oats and barley combined, explain a higher proportion of year-to-year variations of acreage than either equation set for the component crops. The effect of changes in wheat acreage was larger for oats and barley combined than for either of them separately. Price

elasticity estimates for barley were 0.19 and 0.14; however, neither of the coefficients was significant. Price elasticity estimates for oats were 0.66 and 0.51 and both coefficients were significant at the 5-percent level.

Corn

Previous studies.--Previous studies relating price and producer response for Canadian grain corn were not available. One study which analyzed past movements in Ontario corn prices suggested that the erratic behavior of prices provided farmers with a very poor basis upon which to make production decisions (143), the implication being that only a very weak linkage, if any, exists between price levels and corn production. In addition, a large proportion of Canadian corn is fed on the farm where produced, a factor which would tend to make corn production less sensitive to price changes.

Current study.--Although significant yield increases have occurred in grain corn production in Canada, our supply response analysis for corn was limited to acreage response. This limitation was imposed to maintain consistency with the supply response analysis for other grains and to avoid extending the scope of this study by necessitating the inclusion of yield-increasing factors. One place where yields were considered was as a variable influencing acreage planted (see equation (13) below).

Two of the 10 regression equations estimated for Canadian corn production are:

(12) $CA = 276.0 + 494.01\ CP + 31.07\ T$
$t = \quad 1.55 \quad 4.29$
$R^2 = .72 \quad E = 1.04$

(13) $CA = 824.8 + 452.13\ CP + 12.28\ CY$
$t = \quad 1.38 \quad 4.19$
$R^2 = .71 \quad E = .96$

Where:

T = Time = 1955-69, 1955 = 1
CA = corn area, in thousands of acres
CP = corn price per bushel, lagged 1 year, No. 2 Yellow Corn, f.o.b. Chatham, Ont.
CY = Ontario corn yield, bushels per acre, lagged 1 year
t = "t" statistic
R^2 = coefficient of determination
E = corn price elasticity

Equations (12) and (13) are very simple models of the response to corn price changes. The two give very similar results in terms of coefficients of determination and the price elasticity they estimate. The price coefficients are not significant at the 5-percent level, but they are at the 10-percent level. The estimated price elasticities were 1.04 and 0.96, respectively.

Beef

Beef production by its very nature is a relatively long-term enterprise. The gestation period for a cow is 9 months, and, in most cases, each calving produces only a single calf. In addition, the process from calf to finished beef usually involves 12 to 24 months. Increasing the reproductive base of the beef herd involves approximately the same delay since a cow is normally 2 or more years old when she produces her first calf. The net result is a relative inflexibility of supply response to price changes.

Previous studies.--J.S. Lohoar, in an article examining 1949-68 trends in cattle numbers in Canada, suggests that in recent years beef supplies have been sustained by two forces: Increased feeding of cattle resulting in heavier carcass weights, and increased slaughterings, partly at the expense of breeding herds. Neither force can continue indefinitely. Lohoar suggests that there is an inverse relationship between beef prices and growth of the total cattle herd. This is because an immediate response to higher beef prices can be made only by marketing cows and heifers which were being retained for the breeding herd. Conversely, a fall in beef prices may be an inducement to retain cows and heifers for the breeding herd (120).

T.C. Kerr, in a study of regional supplies of slaughter cattle in Canada, reemphasizes the importance of inventory in determining the level of slaughterings (113). The basic purpose of Kerr's study was to identify and quantify the relationship between selected inputs and beef output by region. His regions coincide with Provinces except that the Maritime Provinces were combined into one region and no model was developed for Quebec. He made no attempt to develop a single model for all of Canada. His best models, judged by R^2, are for Alberta and Ontario and are presented below:

Alberta

$$Y = -160 + 60X_1 + 13.42X_2 + .93X_3 + .79X_4 + .029X_5 - .037X_6 + .021X_7$$

$$t = \quad 3.3 \quad 9.5 \quad 4.3 \quad 4.3 \quad 3.8 \quad -4.0 \quad 1.4$$

$$R^2 = .98$$

Where:

time = 1941-66
Y = slaughter steers and heifers marketed, 1,000 head
X_1 = beef cows on farms on December 1, 1,000 head, lagged 3 years, and transformed to eliminate serial correlation with X_2
X_2 = trend
X_3 = steers on farms on December 1, 1,000 head, lagged 1 year
X_4 = calves on farms on December 1, 1,000 head, lagged 2 years, and transformed to eliminate serial correlation with X_1
X_5 = farm stocks on July 31 plus production of barley and oats, 1,000 short tons, lagged 1 year
X_6 = July 31 farm stocks of wheat, 1,000 short tons, lagged 1 year
X_7 = farmers' marketings of wheat, 1,000 short tons, lagged 2 years
t = "t" statistic
R^2 = coefficient of determination

Ontario

$$Y = -480 + .85X_1 + 1.08X_2 + .37X_3 + .57X_4 - .58X_5 - 6.26X_6 + .052X_7$$

$$t = \quad 5.3 \quad 3.1 \quad 1.9 \quad 1.6 \quad -1.1 \quad -2.9 \quad 3.3$$

$$R^2 = .97$$

Where:

time = 1941-66
Y = slaughter steers and heifers marketed, 1,000 head
X_1 = beef cows on farms on December 1, 1,000 head, lagged 3 years
X_2 = steers on farms on December 1, 1,000 head, lagged 1 year, and transformed to eliminate serial correlation with X_1
X_3 = calves on farms on December 1, 1,000 head, lagged 2 years, and transformed to eliminate serial correlation with X_1

X_4 = feeder cattle purchases, 1,000 head, lagged 1 year
X_5 = steer-hog price ratio, lagged 1 year
X_6 = hog-barley price ratio, lagged 1 year
X_7 = production of oats, barley, corn, fodder corn, and mixed grains, 1,000 short tons, lagged 1 year
t = "t" statistic
R^2 = coefficient of determination

The two models explain year-to-year variations in slaughter steer and heifer marketings very well, but most of the explanation is due to the inventory variables. The effect of prices is not clarified. The Alberta model does not even include a price variable. Models for each of the three Prairie Provinces contained one or more variables to relate cattle slaughter to the wheat economy, with the expectation that high farm wheat stocks would induce farmers to increase beef production. However, in all three Provinces the reverse was true--that is, low wheat stocks were associated with an increase in beef production. The study offered no explanation for the strange relationship.

Current study.--The detailed Kerr study provides adequate specification of the relationships between wheat, feed, and cattle inventory variables and Provincial output of slaughter steers and heifers. But, since the study lacks estimates of the effect of selected price variables on production, 10 regression runs were made in an attempt to specify some of the missing relationships. Three of the better equations are presented below.

(14) QB = -738.93 + 23.44 PS + 1.508 S
t = 2.88 8.15
R^2 = .93 Es = 0.39

(15) QB = 398.72 + 0.62 C-2 - 20.93 CP
t = 10.02 2.29
R^2 = .95 Ec = 0.24

(16) C = 2405.10 - 44.84 PS + 120.43 T
t = 2.41 9.61
R^2 = .95 Es = -0.44

Where:

T = time = 1955-69
QB = quantity of beef produced, million pounds
PS = slaughter steer prices, current year
S = number of steers on farms on December 1, 1,000 head, lagged 1 year
C = number of beef cows on farms on December 1, 1,000 head, unlagged, lagged 1 year, or lagged 2 years as indicated by the accompanying digit
CP = cow prices, no lag
t = "t" statistic
R^2 = coefficient of determination
Es = steer price elasticity
Ec = cow price elasticity

Equations (14) and (15) demonstrate that beef production is largely a function of inventory constraints, here either steer numbers or beef cow numbers. In addition, the two equations indicate a significant response to price. The estimate of beef supply elasticity based on equation (14) is 0.39. Equation (15), appearing to differ with Lohoar's analysis (120), indicates that high cow prices are related to decreased beef production. The difference probably results because Lohoar used total cow numbers rather than beef cows and thus included changes in the rate of decline of dairy cow

numbers along with changes in the beef herd. Equation(16) adds support to Lohoar's suggestion that on a short-run basis, high beef prices tended to slow the growth rate of the breeding herd.

Pork

Previous studies.--The best available source of supply response estimates in Canadian pork production, a study by T.C. Kerr (113), indicates that it is possible to functionally separate Canada into two pork-producing regions, the Prairie Provinces and the rest of Canada. In the Prairies, pork production is largely a function of the state of the wheat economy, while in the rest of Canada, pork production depends on the feed situation and alternative opportunities, especially other livestock enterprises.

Using methodology similar to that used in his study on beef, Kerr separates Canada into seven pork-producing regions (Provinces, except the Maritime Provinces, which are combined and treated as one region) and attempts to quantify the variables that have significant effects on hog production. His best models, as judged by R^2, are for Alberta and Ontario and are presented below:

Alberta

$$Y = 2241.9 + 0.092X_1 - 0.047X_2 + 0.33X_3 + 1.15X_4 + 1.62X_5 - 13.34X_6 + 0.26X_7$$
$$t = \quad 2.1 \quad - 1.0 \quad 3.4 \quad 3.0 \quad 8.8 \quad -1.7 \quad 1.8$$
$$R^2 = .95$$

Where:

time = 1945-66
Y = total hog carcasses graded, 1,000 head
X_1 = farm stocks July 31, plus production of wheat, 1,000 tons, lagged 1 year
X_2 = farm marketings of wheat, 1,000 tons, lagged 2 years
X_3 = farm stocks July 31, plus production of barley, 1,000 tons, lagged 1 year
X_4 = hogs under 6 months old on farms on December 1, 1,000 head, lagged 1 year, and transformed to eliminate correlation with X_5
X_5 = pigs saved June-November, 1,000 head, lagged 1 year
X_6 = time variable
X_7 = hog-wheat price ratio times 100, lagged 1 year
t = "t" statistic
R^2 = coefficient of determination

Ontario

$$Y = 4.11 + 0.59X_1 + 7.91X_2 + 0.67X_3 - 1.10X_4 + 27.29X_5 + 47.31X_6 + 5.27X_7$$
$$t = \quad 0.4 \quad 2.1 \quad 2.4 \quad - 2.9 \quad 2.2 \quad 4.8 \quad 1.4$$
$$R^2 = 0.92$$

Where:

time = 1948-66
Y = total hog carcasses graded, 1,000 head
X_1 = sow carcasses graded as a percentage of total carcasses, multiplied by 10,000, lagged 1 year
X_2 = turkey, fowl, and chicken meat sold, million pounds, expressed as a percentage first difference and lagged 1 year
X_3 = pigs saved, June-November, 1,000 head, lagged 1 year
X_4 = margin between good slaughter steers and good feeder steers at Toronto, Canadian dollars per cwt. multiplied by 10, lagged 1 year

X_5 = hog-barley price ratio multiplied by 10, lagged 1 year
X_6 = time variable
X_7 = chicken-hog price ratio (Canadian cents per lb./Canadian dollars per cwt.) multiplied by 1,000, expressed as percentage first difference and lagged 1 year
t = "t" statistic
R^2 = coefficient of determination

In the Prairie Provinces, lower expectations regarding wheat profitability resulted in switches to other enterprises such as hogs. In eastern Canada, farm production is not dominated to such a large extent by any one product; therefore, to capture the effects of other enterprises in his Ontario model, Kerr included variables for poultry and livestock feeding. In the Ontario model, the variable representing the profitability of feeding cattle had a negative sign and was significant, indicating that cattle feeding also is an alternative to hog production. However, the variable for poultry production gave confusing results. Kerr's attempt to include opportunity costs in the Alberta equation resulted in significant tests for the coefficient on the wheat-hog price ratio. The inclusion of wheat stocks gave a significant coefficient, but the two Alberta models had opposite signs on the coefficient.

Current study.--Kerr's models demonstrate that for a short-run changes, pork production, like beef production, is largely dependent on inventory variables. None of his models included a variable which directly represented pork prices. To overcome that shortcoming, we ran 12 regressions that included price variables. Four of the more significant runs are presented below.

(17) QP = 820.9 + 2.97 PP + 14.5 T
t = 0.32 2.09
R^2 = 0.35 E = 0.08

(18) QP = 172.9 + 5.32 PP + 27.8 SP + 1.0 BFS
t = 0.68 2.93 0.79
R^2 = 0.50 E = 0.14

(19) QP = -137.5 + 21.48 H/B + 30.8 SP + 3.32 T
t = 2.60 2.16 0.36
R^2 = 0.66 E_{HB} = 0.41

(20) QP = 183.2 + 18.71 H/B + 35.3 SP + 0.12 WFS
t = 1.56 4.54 0.28
R^2 = 0.66 E_{HB} = 0.43

Where:
time = 1955-69
QP = quantity of pork produced, million pounds
PP = pork price, all Canada, price of grade B slaughter hogs, lagged 1 year
T = trend = 1955-69
SP = good slaughter steer prices at Toronto, lagged 1 year
BFS = August 1 farm stocks of barley, million bushels, lagged 1 year
WFS = August 1 farm stocks of wheat, million bushels, lagged 1 year
H/B = hog-barley ratio, crop year basis, lagged 1 year
t = "t" statistic
R^2 = coefficient of determination
E = pork price elasticity
E_{HB} = elasticity of the hog-barley ratio

Equations (17) and (18) indicate that the price elasticity of pork production is very low, ranging from 0.08 to 0.14. However, none of the price coefficients was

significant, indicating that little confidence can be placed in the elasticity estimates. Supply response to changes in the hog-barley ratio is more elastic--0.41 and 0.43 in equations (19) and (20), respectively.

These four models differ from Kerr's models for the Prairie Provinces in that they indicate little or no reaction to farm stock levels of either wheat or barley. Additionally, Kerr's Ontario model indicated a significant competitive relationship between hogs and feeder steers, while equations (18), (19), and (20) indicate that steer price increases have been followed by pork production increases. Both of the above differences probably result because the equations here are based on total Canada data while Kerr used regional analysis.

VI. MAJOR FACTORS AFFECTING LOCATION OF PRODUCTION AND GROWTH POTENTIAL THROUGH 1975

Developments responsible for some of the growth in Canadian grain and livestock production during 1960-70 were discuseed in chapter IV. This chapter investigates factors that are likely to influence production trends through 1975. The discussion covers: (1) technological developments and changes in management techniques and inputs, and (2) regions of the country where production increases will probably occur.

Technology, Management, and Inputs

The potential for increasing grain and livestock production through changes in technology, management, and inputs is examined in this section. The possibility of wide use of currently available techniques and inputs, as well as the introduction of new techniques and inputs now in the experimental stage, are discussed.

Grains

Some of the principal factors that could lead to substantial yield improvements for Canadian grain crops are improved varieties and new grains, increased use of fertilizers and pesticides, and improved cultivation techniques.

Higher yielding varieties of bread wheat, barley, and oats.--Bread wheat yields will probably increase in Canada by 1975 because of more widespread use of Neepawa wheat (see chapter IV, p. 55) and the introduction of new varieties with yield characteristics similar to Neepawa. Other new varieties may come about as byproducts of hybrid wheat and feed wheat experiments.

Barley-breeding programs will be geared more to feed types of barley than in the past (when breeding concentrated on malting varieties). Although new semi-dwarf, 2-row barley varieties for both feed and malting are likely to be introduced by 1974 (246, Mar. 11, 1971), overall barley yield increases are expected to be modest (117, p. 89).

New oats-breeding materials, now in the experimental stage, show great potential for increased feeding qualities over present varieties. Introduction of new varieties based on these materials could slow the decline in oats acreage (246, Mar. 11, 1971; 117).

Feed wheat.--High-yielding feed wheats will most likely affect Prairie cropping patterns by 1980. The 1969 report of the Canadian Task Force on Agriculture envisioned a total of 20 million acres of wheat seeded in Canada in 1980, of which 8 million would be high-yielding varieties (around 32 bushels per acre) suitable for feed or lower quality milling markets (49, p. 96). Canada's wheat-breeding program traditionally

concentrated on improving established varieties of bread wheat, with the main emphasis on baking quality and resistance to diseases and pests. In the last few years, however, some emphasis has been placed on producing high-yielding varieties, with less regard given to quality.

The first licensed feed wheat to emerge from feed wheat-breeding programs was Pitic 62, which was introduced in 1969. This variety, adapted to growing conditions in the Parkland area of the Prairies, proved to be unsatisfactory because of relatively low yields, susceptibility to rust, low bushel weight, and late maturation. It is useful as a breeding material, however. Another new feed variety, 714-A, was in the experimental stage at the time of writing but may be licensed in 1972. It is expected to yield 20 or 25 percent above Manitou (a popular variety during the past several years) under farm conditions and responds very well to nitrogen fertilizer. Other new varieties are also likely to be licensed before 1975, some of which could have yield potentials up to 50 percent above Manitou (246, Mar. 11, 1971; 249, Feb. 18, 1971).

Hybrid wheat and barley.--Canadian plant scientists are experimenting with hybrid varieties of wheat, primarily feed wheat, but no breakthroughs are expected before 1975. There are no major hybrid barley breeding programs underway in western Canada, but U.S. programs are being closely watched. A hybrid barley suited to Canadian climatic conditions will be introduced one day, but probably not before 1975 (246, Mar. 11, 1971).

Grain corn.--Canada's corn-breeding program has been instrumental in expanding the northern and eastern frontiers of corn cultivation in eastern Canada. This progress will continue through 1975. Currently, the breeding program is beginning to develop new varieties suitable for western Canada. Prairie areas best suited to grain corn production are an area of south-central Manitoba known as the Pembina Triangle and the irrigated area of southern Alberta. The climatic obstacles to corn production in these areas remain formidable, however, and greatly expanded acreage over the approximately 6,000 acres planted in 1970 remains unlikely before 1975 (246, Apr. 29, 1971, and May 13, 1971; 247, Apr. 2, 1971).

Fertilizer use.--A further increase in fertilizer use would increase Canadian grain crop yields, especially in the Prairie Provinces. In the mid-1960's, Prairie farmers were reportedly using only a fraction of agronomically optimal fertilizer applications. By 1968, some improvement had occurred. Prairie fertilizer sales per seeded acre more than doubled between 1964 and 1968, and in Manitoba alone, sales almost quadrupled (table 27, p. 56). Nevertheless, there appears to be a large gap between 1968 fertilizer use and optimum use throughout most of the Prairies.

Two other factors--the effect of fertilizer on grain protein levels and the substitutability of fertilizer for summer fallowing--could have an important influence on growth of Prairie fertilizer consumption. Tests on wheat and barley at the University of Manitoba showed that additions of nitrogen fertilizer not only improved yields, but substantially increased the protein levels of both grains. If the price incentives to produce high-protein wheat under Canada's new protein-grading system are high enough, investments in fertilizer use could be associated with improving wheat protein levels (167, pp. 6-7). Also important, given high returns for grain production, could be the effect of decreases in summer fallowing. Such decreases would require increased use of nitrogen fertilizer on stubble-cropped land to maintain yields (128).

Pesticide use.--Yield advances that can be made by increased use of pesticides are more limited than those possible through increased fertilization. As of the late 1960's, the use of pesticides, particularly herbicides, was quite widespread throughout Canada's grain-growing areas. A factor limiting increased pesticide use is the growing awareness in Canada of the harmful effects of some pesticides upon the environment.

Cultivation techniques.--Improved farming techniques, including more efficient use of available moisture and better soil management, could result in increased grain yields in the Prairies by 1975. Some of the techniques involved are terracing and banking to collect snow and spring run-off (very costly), the use of furrow drills to place seed and fertilizer at moisture level, the conservation of crop residues at or near the surface, minimal and shallow tillage on summer fallow during periods of high evaporation, improved weed control, more flexible combinations of crop-fallow rotations and fertilizer use, and increased use of soil-improving crops (85, p. 75, 97, pp. 418-420; 117, p. 88).

Cattle

The principal factors responsible for rapid growth in Canada's output of cattle during the 1960's--increased average slaughter weight and withdrawal of cattle from the breeding herd--cannot be important growth factors in the 1970's. The increase in carcass weights was mainly a result of growth in feedlot finishing, which is now a widespread practice whose further growth is limited. The decline in the breeding herd was reversed in 1969 and cannot soon be repeated if Canada is to remain near self-sufficiency in beef production (120).

The most important growth factor in output of cattle through 1975 will most likely be increased area and productivity of forage and pasturelands. Other changes which show potential for increasing cattle output are: (1) new types of beef animals; (2) new technology and management practices for feeder cattle production; (3) improved feedlot productivity; and (4) expanded use of artificial insemination and other biological control techniques.

Increased area and productivity of forage and pasture.--Most growth in Canada's beef cattle herd over the next several years will come from increased forage and pasture in the traditional grazing areas of western Canada. New Government policies, 33/ lower wheat prices, and strong demand for feeder calves are providing real incentives for converting marginal grainland to forage in western Canada. The Canadian Task Force on Agriculture Report (49), in recommending that 4 million acres of grainland be transferred to forage crops, calculated that the output of feeder calves from cow-calf operations on this acreage could reach 720,000 a year once the land reached full production. Most of the switch from grain to forage is expected in traditional cattle-producing areas on farms already producing cattle.

Reseeding native pastures can greatly increase carrying capacity. Seeded pasture can produce three times the feed of native pasture, and both the animal rate of gain and calving percentages are higher on seeded pasture. In 1966, only 10 percent of pastureland in the Prairies was improved by seeding (see table 15, p. 23). A study of Alberta's pasture resources in 1965 concluded that reseeding native pasture to tame forage had substantial potential as a profitable method of increasing forage production in all areas of the Province (123, p. 33). Short-run production increases from seeding pastures are limited, however, because reseeded land will not come into full production until the fourth year after reseeding (182, p. 11).

The clearing of new land for pasture still has some potential for increasing cattle production. Of the presently unused land in the Prairie Provinces with potential for development as pasture, most lies in the black and gray wooded soil zones. According to a 1967 Saskatchewan report, 2.6 million acres of lightly forested land in the black and gray wooded soil zones (1961 data) and 3 million acres in Provincial forest reserves had potential for development as pasture. Unstated additional acreage

33/ For a discussion of the forage incentive program and other programs, see ch. IV, pp. 73, 74.

could be made available for pasture through drainage development (114). A report on Alberta pasture resources estimated that over 800,000 acres of privately owned idle and virgin land could be profitably developed as pastureland. Most of this is in the northern part of the Province (123, p. 12).

Forage production in western Canada could be increased through adoption of improved management practices, including installation of additional water facilities, fertilization of pasture, rotation of grazing, fencing, and control of brush. Fertilizer application has the greatest potential for improving pasture yields--increases of 40 to 150 percent could be expected. Brush control could increase carrying capacity by 50 percent over unimproved native pasture, and the addition of water facilities could lead to a 25-percent increase in utilization in the drier areas (114; 123, pp. 18-19).

New sources of beef animals.--Growth in Canadian beef cattle output will probably result in part from increased utilization of bulls, heifers, dairy breeds, dairy crossbreeds, and exotic (European) crossbreeds for beef production. Growth will be realized only in the long run, however, because of the long reproductive cycle of cattle.

Young bulls gain 10 to 15 percent more rapidly than steers, are more efficient in converting feed to meat, and produce carcasses with approximately 10 percent more lean beef. By 1975, new beef-grading standards that are more favorable to lean meat may be adopted in Canada. To date, use of bulls as beef animals has been limited because production and marketing requires more intensive management and hence results in higher costs (121, p. 451; 168, p. 85).

In 1970, heifers accounted for only 21 percent of all cattle slaughterings in Canada. Since only about 40 percent of the heifer crop is needed for herd replacement, the proportion slaughtered could increase. Use of hormones to abort pregnant animals reduces the hazard of feeding heifers for beef production, and drugs to eliminate estrus can improve the rate of gain of heifers so it approaches that of steers (14, p. 14; 121, p. 452; 168, p. 86).

Dairy breeds and dairy crossbreeds will become somewhat more important in beef production. Holstein cattle and beef-Holstein crossbreeds are rapid weight gainers, and the proposed new beef-grading system would favor the lean meat produced by these animals. The potential for this source of increased production is limited, however, by the strong demand for female dairy breeding animals and by high prices for veal calves and dairy products (14, p. 14; 49, p. 15; 168, p. 85).

The crossbreeding of traditional beef breeds with new breeds currently being imported from Europe, particularly Charolais and Simmental, could lead to greatly increased productivity of beef cattle. Crossbred cows mature earlier, have a higher conception rate and a higher milking ability, and can produce 10 to 25 percent more beef. Slow growth of crossbreeding to date is partly due to necessary cost increases for higher quality pastures and greater supervision of breeding stock. Also, traditional attitudes favor established breeds. Despite expected increased importance of crossbreeds over the next several years, significant results won't be visible until after 1975 (93, p. 18; 121, p. 451; 168, p. 85; 240, Mar. 1971).

New technology and management practices in feeder production.--Potential new sources of increased feeder cattle output are (1) increases in the number and output of joint dairy and beef operations (traditional dairy combined with a dairy steer-feeding enterprise) and (2) confinement rearing of calves.

The Canadian Task Force on Agriculture and the Quebec Department of Agriculture and Colonization have encouraged dairy producers in eastern Canada to establish joint beef-dairy operations to increase beef production. However, because of dairy subsidies,

good prices for veal calves and dairy heifers, and the problem of irregular income from beef enterprises, the prospects for more joint beef-dairy operations are limited, and beef production increases from such operations will be very modest.

Confinement or drylot feeding of beef breeding cows offers potential for increasing beef calf productivity in areas where conditions are favorable for intensive production. A principal advantage of this type of operation is that producers have complete control over all phases of production--that is, new management techniques such as estrus control, artificial insemination, sex determination, and ration control can be practiced more easily. Another advantage is more efficient feed utilization--mechanically harvested forage yields are at least 1-1/2 times as great as seeded pasture yields. Confinement rearing of calves is already underway on a small scale in Canada, but it is unlikely to become of major importance for many years (14, p. 14; 168, p. 86; 170, p. 412).

Improved feedlot productivity.--Because feedlot finishing of beef cattle is now widespread in Canada, future growth in beef cattle production resulting from the adoption of this technology will be limited. However, there is still some room for expansion and improvements in feedlot management could substantially contribute to improved beef cattle output. One such improvement is increased use of starters and high-energy rations. The housing of feeders in environmentally controlled buildings has begun on an experimental basis, but the large investment required will limit use of this operation before 1975. Perhaps the greatest improvement in feedlot efficiency will come through a continuation of the trend toward larger commercial feedlots. The large lots are able to take advantage of efficiency-improving techniques such as automated feeding and modern methods of calculating the least-cost mix of inputs (3, p. 30; 121, p. 454; 196, pp. 86-87).

Expansion of artificial insemination and new biological control techniques.--Canadian beef cattle breeders currently make only limited use of artificial insemination and this is restricted mostly to crossbreeding operations. Wider use of artificial insemination will probably increase in the future and result in improved productive efficiency in the beef industry, as it did in the dairy industry. Principal gains would be a wider use of performance-tested bulls, increased use of crossbred cattle, and a reduced requirement for breeding bulls (93, p. 18).

Several new biological-control methods of improving beef cattle productivity, such as induced twinning, control of the estrus cycle, and control of sex, are presently in the experimental stage. The economic impact of these techniques would be spectacular, but none are expected to be widely used by 1975 (93, pp. 18-23).

Hogs

Efficiency of Canadian hog production will continue to improve through 1975. The trends for producers to become more specialized, both in size of operation and function, and to adopt more mechanized techniques will continue and will be the major source of increased pork productivity. Particularly important is the expected increase in the number of hog producers in the Prairie Provinces planning to stay permanently in the business. In the past, many Prairie hog producers were "in-and-outers"--that is, they went into the hog business only when they had to dispose of surplus grain. These producers tended to be relatively inefficient. Now, however, it appears that many recent entrants to hog production plan to stay in the business and build up their expertise.

Much experimental work is now underway in confinement rearing of hogs, using techniques similar to those that brought chicken prices down in previous years. The impetus of a cold climate has placed Canadians in the forefront of this sort of development (15, p. 15).

Changes in the Location of Production

Grains

For many years, all expansion in Canadian grain acreage has been in the West. This trend is expected to continue and future acreage growth, if any, will be in the Prairie Provinces. In 1970, over 79 million acres of land in the Prairies were planted to crops or left in summer fallow, but approximately 25 million more acres are suited to grain production. Much of this land is along the northern fringe of the productive area, but most of it consists of unbroken land on established farms throughout the Prairies.

Grain acreage, however, is not likely to increase much, if at all, by 1975, and shifts in acreage will probably be from higher cost areas to lower cost areas. William Craddock's recent study, Interregional Competition in Canadian Cereal Production (63), identifies these areas and, for various export and policy assumptions, allocates production to lowest cost areas. With 1966 as a base, grain acreage shifts were considered assuming annual wheat exports of 420 million, 350 million, and 300 million bushels. 34/ Government policies were assumed to remain unchanged; that is, the feed freight assistance program would continue and grain corn imports would be permitted over the 8-cent-a-bushel tariff.

Under the three export levels, 1966 acreage was in excess of consumption and export requirements by 2.2 million, 7.4 million, and 11.0 million acres, respectively. Alberta (including the Peace River district of British Columbia), Manitoba, and Quebec accounted for most of the excess grain acreage under the export assumption of 420 million bushels. Under the other two export assumptions, most of the excess acreage was divided among the three Prairie Provinces. In the Prairies, the uncompetitive areas under all three assumptions were eastern Manitoba, the interlake area of Manitoba, and northern Alberta (including the Peace River district of British Columbia). Under the two lower export levels, northern Saskatchewan and northwestern Manitoba were also uncompetitive. Large areas of Other Canada (the Maritimes, Quebec, and British Columbia) were found to be uncompetitive for grain production (for example, 29 to 72 percent of Quebec's grain acreage was uncompetitive under the various assumptions), but as a proportion of all Canada, this acreage was small. Ontario had very little uncompetitive acreage under all assumptions. Saskatchewan was shown to have a relative advantage in wheat and Alberta a relative advantage in barley--confirming production shifts during the 1960's (63, pp. 20-43).

Between 1971 and 1973, Canada's forage incentive program will have subsidized the conversion of up to 4 million acres of cropland and summer fallow land in the Prairie Provinces to perennial forage. 35/ It is expected that this acreage will be mainly in areas already specializing in extensive cattle grazing operations, mostly in an area covering southwestern Saskatchewan, southern Alberta, and western Alberta as far north as the Red Deer Area. 36/ In some parts of this area, particularly southwestern Saskatchewan, limited availability of palatable water will limit forage expansion. There will also be some forage expansion in the mixed-farming area of the Parkland (black soils).

34/ Grain includes wheat, barley, oats, rye, mixed grain (in eastern Canada only), and corn (in Ontario only).

35/ The program is described in ch. IV, p. 73 .

36/ Red Deer County is about halfway between Calgary and Edmonton.

Protein grading of wheat, introduced in 1971, 37/ is expected to increase the relative attractiveness of wheat production in those areas which tend to produce higher protein level wheat. In any one area, the protein levels of wheat produced vary from year to year, but certain regions of the Prairies tend to produce higher protein wheat than others. On the average, the highest protein wheat (14 percent or over) is grown in western and central Saskatchewan and parts of eastern Alberta. High-protein wheat (13 percent or over) is also grown in eastern Saskatchewan, southwestern Manitoba, and western Alberta. The northern, western, and eastern fringes of the grain-growing area of the Prairies consistently produce lower protein wheat (63, pp. 87-88; 133, p. 23).

Cattle

Canada has the land and grain-producing resources to easily meet rising levels of beef consumption. However, given present prices, not all of these resources could be profitably allocated to beef production.

Cow-calf operations. -The Prairie Provinces will continue to be the main suppliers of Canadian feeder cattle. Cow-calf operations in the Prairies will expand on relatively low-cost land that does not have good alternative uses. Ontario forage land is too expensive to allow for substantial expansion in cow-calf operations. The land can be used more profitably for other enterprises, mainly dairy farms.

Other possible areas of expansion are the Maritime Provinces and the Clay Belt Area of Ontario and Quebec. The latter is a frontier area with over 9 million acres of land suitable for agricultural development. There have been some experimental cow-calf operations in the area, and the Quebec Government subsidizes farmers establishing beef cow herds there; but no significant development is likely to occur in the near future. Production in the Maritimes will not be on a large scale (119, p. 17; 168, p. 88; 240, May 1969 and Aug. 1969).

Feedlot operations.--Cattle feeding in Canada is concentrated in Alberta and western and southwestern Ontario. 38/ Alberta's industry has been growing faster than Ontario's and is expected to continue doing so through 1975. Alberta's comparative advantage over Ontario lies in a ready supply of feeders. Ontario, however, has advantages of a milder climate and the availability of corn silage, and it can be expected to maintain its position as a major cattle-feeding area (14, p. 15). A cattle-feeding industry is beginning to develop in Manitoba and Saskatchewan and is expected to increase somewhat in relative importance. The severe winters in these two Provinces are considered a handicap to the development of cattle feeding, but a recent study found that if feeders in these Provinces were kept dry and sheltered from the wind, they performed as efficiently as those in Alberta or Ontario (181).

Hogs

The most pertinent aspects concerning the location of hog production in Canada are its highly dispersed nature (see fig. 12, p. 41) and the relatively high fluctuation of hog numbers in the Prairie Provinces. The Canadian hog population is distributed surprisingly evenly across the country--a situation vastly different from that in the United States, where 57 percent of the hog population is concentrated in five contiguous States. 39/ Canada's feed freight assistance policy is one of the factors contributing to this even distribution. Through the 1960's, the Prairie Provinces accounted for 42 percent of Canada's hog population, but in 1970 the Prairie share rose

37/ The new wheat grading scheme is described in footnote 6, p. 6).

38/ Western Ontario is the area east of Lake Huron and south of Georgian Bay. Southwestern Ontario is east of Detroit and south of Lake Huron (see fig. 9, p. 36).

39/ Iowa, Minn., Mo., Ill., and Ind. in 1969.

to 51 percent as farmers attempted to dispose of farm stores of surplus grain. A similar situation occurred in the late 1950's, but hog numbers declined as the grain delivery situation improved. Although much of the 1970 increase was also of a temporary nature, a large proportion of the latest growth in the Prairie hog industry was accompanied by heavy capital expenditures for hog barns and other facilities and an acceptance of the necessity to diversify Prairie agriculture. Thus, it appears that a definite and permanent shift in hog production is occurring, and that the Prairies will supply a larger proportion of Canada's pork than previously.

VII. PROJECTIONS THROUGH 1975

The objective of this chapter is the development of a plausible set of projections for Canada's 1975 grain and livestock production. Two projection sets are developed: one based on a continuation of recent price levels and the other assessing the effect of a downward revision of grain prices. Before developing our projections, we review previous projection studies.

Previous Projection Studies

CDA

Methodology.--The most complete set of supply-demand projections for Canadian agriculture is a 1968 Canada Department of Agriculture study by Yankowsky, Shefrin, and Cavin entitled Demand-Supply Projections for Canadian Agriculture--1980 (192). The projections, which assume a continuation of 1968 policies, are national and long-range in scope. They rely heavily on past trends and on historical relationships between certain variables, although where new information gave additional insight, subjective judgments were used to modify the projections. Production projections were based on extrapolation of 1949-66 trends. Crop production projections were based on acreage and yield trends, while livestock projections were based on animal numbers, slaughterings, and average carcass weights. The CDA projections and those of other organizations are presented in table 44.

Canada's population was assumed to be 23.7 million in 1975 and 26.1 million in 1980. Real per capita gross national product (GNP) of Can$3,070 in 1975 and Can$3,466 in 1980 were assumed. A 1957 base was used in calculating real GNP.

Domestic demand for wheat and meat was projected on the basis of expected changes in per capita demand due to income changes and expected population growth. Once total requirements for meat were estimated, feed grain requirements were calculated. Two different assumptions regarding feeding levels were used to determine feed requirements. The lower figure, 0.85 ton per animal unit annually, implies no change in feeding practices, while the higher figure, 0.95 ton per unit, implies an increase in feeding intensity.

Production.--Highlights of the CDA projections to 1980 include: 31 million acres of wheat planted, with yields averaging 28.0 bushels an acre; coarse grain production of over 1 billion bushels, with oats and barley accounting for three-fourths of the total; and corn yields of over 100 bushels an acre. Beef and veal production was projected to be over 2.9 billion pounds, and pork production to approach 1.4 billion pounds. Comparing some of these 1980 projections with 1969 and 1970 levels indicates that some of the projections have already been reached, particularly those for oats and barley area. In addition, average beef carcass weight in 1969 was only 1 pound less than the weight projected for 1980.

Table 44.--Projections from previous studies, supply of selected agricultural commodities, Canada, 1975 and 1980, and comparison with 1969 and 1970 actual data

Item, study, and year	Wheat	Coarse grains	Oats	Barley	Corn	Mixed grains	Rapeseed	Beef slaughter		Pork slaughter
								Calves	Cows	
	1,000 acres							1,000 head		
Area and number:										
CDA, 1980.	31,000	19,720	7,000	9,000	1,300	1,600				10,690
OECD, 1975	31,500	18,755	7,400	7,750	1,250	1,500	1,500	1,200	3,752	
FAO, 1975.	28,911	19,793								
Recent normal 1/ . . .	24,968		7,149	9,535	1,190		3,950	904	3,255	8,730
	Million bushels							Million pounds		
Production:										
CDA, 1980.	868	1,012	392	378	134	88	41		2/2,900	1,358
OECD, 1975	850	929	400	310	118	82		143	2,067	1,252
FAO, 1975.	692	3/(16.8)							2/2,222	1,234
ERS, 1980.	683	3/(18.3)								
Recent normal 4/ . . .	617		337	360	98		67		1,801	1,134
	Bushels per acre							Carcass weight-pound		
Yield:										
CDA, 1975.								130	545	127
CDA, 1980.	28.0	51.3	56.0	42.0	103.0	55.0		135	555	127
Task Force, 1980 . . .								127	555	135
OECD, 1975	27.0	49.5	54.1	48.8	94.4	54.7		119	550	
FAO, 1975.	23.9									
Recent normal 5/ . . .	24.7		47.2	37.8	82.2		17.0	119	554	130

1/ Wheat, barley, and livestock data are 1969 actual figures. Oats, corn, and rapeseed are 1970 actual acreages.
2/ Includes veal.
3/ Million metric tons.
4/ Recent normal production equals the "normal" acreage estimate multiplied by the "normal yield."
5/ Average 1966-70 yield for crops. 1969 actual for livestock.

Sources: CDA (192); OECD (146); FAO (75); Task Force (49); ERS (155).

Domestic disappearance.--CDA projections of 1980 domestic disappearance of grain and livestock products (table 45) are based on projections of 1980 per capita demand for bread wheat and meat products, which were multiplied by projected population and adjusted for other uses to get total demand. For feed grains, demand was calculated from projected demand for meat. The projections show per capita flour consumption declining to 116 pounds by 1980 and per capita beef and veal consumption rising to over 100 pounds. Table 45 also lists the results of CDA beef projections made in 1964.

Trade.--Because of the number of unknown and uncontrollable variables, trade projections are usually more uncertain than production or consumption projections. Consequently, there is considerable variation in the trade projections shown in table 46. CDA projects 1980 exports of 625 million bushels of wheat and close to 50 million bushels of coarse grains. Beef exports are projected at 100 million pounds annually and pork exports at half that.

Task Force

Methodology.--The Canadian Federal Task Force on Agriculture Report, completed in 1969, had as its objective the formulation of policies to alleviate Canadian farm problems, and its projections must be viewed in light of that objective (49). The Task Force projected total demand (domestic disappearance plus export) for the major agricultural commodities and assumed that the adoption of their policy recommendations would cause supply to adjust to the projected demand.

On the supply side, the basic assumption was that by 1980 approximately 10 million acres would shift out of wheat and into production of rapeseed, coarse grains, and forage crops. A second assumption was that a total of only 1 million acres would be added to the improved land category between 1966 and 1980, which compares with approximately 1 million acres added annually in the years prior to 1966. Since it appears that the Task Force supply projections were not made independently of demand, the area and total production projections made by the Task Force are not included in table 44.

Demand projections made by the Task Force are not very explicit in regard to food demand for cereals other than wheat. Demand for cereals for feed was based on the CDA's meat demand projections.

Export demand for wheat was projected by studying and projecting internal supply conditions of Canada's main customers. Coarse grain export projections are based on projections of growth in world demand for feed grains made by the Food and Agriculture Organization of the United Nations (FAO). Feeder cattle export projections were based on the assumption that the Canadian cattle industry could supply one-half million head annually to the U.S. market.

Domestic disappearance.--The Task Force projections for 1980 domestic disappearance of wheat and coarse grains are lower than such projections made by CDA, probably because a more rapid rate of decline in dairy cow numbers is assumed in the Task Force Report. The Task Force assumed grain consumption of 0.90 ton per animal unit, which is between the two levels used by CDA.

Exports.--Export projections are a major part of the Task Force's study. Compared with other studies, the Task Force's 1980 export projection for wheat is pessimistic and those for coarse grains and feeder cattle are optimistic (table 46).

OECD

Methodology.--Canadian projections for 1975 made by the Organization for Economic Cooperation and Development are part of a 1968 project of the Secretariat of OECD (146) The study is based on 1955-65 data, with inclusion of later data when possible. For

Table 45.--Projections from previous studies, total domestic disappearance of and per capita demand for selected agricultural commodities, Canada, 1975 and 1980

Study and year	Wheat	Coarse grains	Oats	Barley	Corn	Veal		Beef		Pork	
						Calves	Pounds	Cattle	Pounds	Hogs	Pounds
	Million bushels					1,000 head	Mil. lbs.	1,000 head	Mil. lbs.	1,000 head	Mil. lbs.
Total:											
CDA--1975. . . .						1,306	166	4,218	2,248	10,370	1,186
1980 1/ . . .	156.0	915.5	359.2	321.5	140.2	1,364	180	4,795	2,605		1,302
1980 2/ . . .	180.0	985.5	384.2	354.5	147.2	1,364	180	4,795	2,605		1,302
1980 3/ . . .						1,100	125	4,600	2,440		
Task Force, 1980	149	846.5	296.0	293.0	162.0	1,364	180	4,795	2,605	11,380	1,302
OECD, 1975. . .	186.3	4/(13.4)							5/2,264		1,252
FAO--											
1975 6/ . . .									5/2,044		1,222
1975 7/ . . .									5/2,133		1,222
Yankowsky--											
1975 8/ . . .						909	116	4,278	2,375		1,246
1975 9/ . . .								4,114	2,282		
1980 8/ . . .						966	127	5,075	2,884		1,366
1980 9/ . . .								4,726	2,682		
ERS, 1980 . . .	157	4/(17.3)									
	Pounds										
Per capita:											
CDA--											
1975.	10/121						7.0		94.8		50.0
1980.	10/116						6.9		100.0		50.0
1980 3/ . . .							5.0		90.0		
Task Force, 1980							6.9		100.0		50.0
OECD, 1975. . .	118								5/93.8		49.8
FAO--											
1975 6/ . . .	126								5/86.6		51.8
1975 7/ . . .	125								5/90.4		51.8
Yankowsky--											
1975 8/ . . .							5.0		102.0		53.5
1975 9/ . . .									98.0		
1980 8/ . . .							5.0		114.0		54.0
1980 9/ . . .									106.0		

1/ 1968 study. Based on a feeding rate of 0.85 ton of grain per animal unit.
2/ 1968 study. Based on a feeding rate of 0.95 ton of grain per animal unit.
3/ 1964 CDA study.
4/ Million metric tons.
5/ Includes veal.
6/ Projection based on low-income assumption.
7/ Projection based on high-income assumption.
8/ Demand projected by a semi-log demand function.
9/ Demand projected by a linear trend (1949-69).
10/ Includes rye flour, retail weight.

Sources: CDA, 1968 study (192); CDA, 1964 study (33); Task Force (49); FAO (75); Yankowsky (190); ERS (155).

Table 46.--Projections from previous studies, agricultural trade, Canada, 1975 and 1980 1/

Study	Wheat	Coarse grains	Oats	Barley	Corn	Beef		Pork meat
						Animals	Meat	
	Million bushels					1,000 head	Mil. lbs.	Mil. lbs.
CDA, 1980. . .	625	43.5	10	25			100	50
Task Force, 1980	364	105	5	100	2/-10	500		
Bjarnason, 1980	720	56						
ERS, 1980. . .	437	3/(1.1)						
Hudson, 1975 .	362			125				
Huff, 1975 . .	4/260							

1/ Projections made independently of the internal supply-demand situation.
2/ Minus indicates imports.
3/ Million metric tons.
4/ Midpoint of his projection range.

Sources: CDA, 1968 study (192); OECD (146); Task Force (49); Bjarnason (18); Hudson (95); Huff (96); ERS (155).

its demand projection, OECD uses Canadian Government population and income projections. A 1975 population of 23.8 million and a per capita consumption level 41.4 percent above the 1962 base are assumed. OECD did not attempt to determine if export markets were likely to be available for future supplies of Canadian farm commodities.

The basic methodology was extrapolation of past trends. For crop production, trends were run on both area and yields and then extrapolated to estimate production. Beef supplies were projected by extrapolating trends in the size of the dairy and beef herds, which were totaled and called the breeding herd. OECD assumed an 85-percent calf crop, of which 1 million calves would be lost or slaughtered for veal. The remaining number of calves are considered as the year's beef crop. Then, by multiplying this number by 551, OECD estimated the beef supply on a carcass-weight basis. The pork supply was estimated by projecting demand and assuming that domestic production would meet it.

Production.--OECD's wheat area projection for 1975, at 31.5 million acres, is the highest of all the projections studied (table 44). Coarse grains area for 1975 was projected at 18.8 million acres, or 1 million acres less than the 1980 CDA projection. OECD projected 1975 veal production at 143 million pounds, while beef was projected at 2.1 billion pounds.

Domestic disappearance.--OECD projected 1975 per capita consumption of wheat flour at 118 pounds, which is nearly the same as CDA's wheat and rye flour projection of 121 pounds. Per capita beef consumption was projected by OECD to be 94 pounds. Since this

projection includes at least 5 pounds of veal, it is considerably below CDA's projection of 95 pounds, which does not include veal.

Trade.--The OECD study made no trade projections. However, taking projected production minus projected domestic demand indicates Canada would have large quantities (664 million bushels) of wheat available for export. The same procedure for beef indicates a possible need for beef imports to satisfy domestic requirements in 1975.

FAO

Methodology.--Like those of CDA and OECD, FAO production projections (75) are basically extrapolations of past trends with subjective modifications made when they appear to be in order. The FAO projections differ in that four types of functions--linear, log, double log, and log inverse--were used to estimate the trend. FAO demand projections are based on U.N. population and income projections and on income elasticities of demand for the individual commodities. The income elasticities were estimated by three types of demand functions--single log, double log, and log inverse--using 1950-65 data. The function giving the best fit (highest R^2) was chosen as the most reliable.

The methodology involves the implicit assumption that policies and price relationships prevailing during the 1961-63 base period will continue. Two growth rates in per capita income were assumed--1.8 and 3.1 percent a year.

Production.--FAO projected lower wheat acreage in 1975 than did either CDA or OECD. In addition, the FAO wheat yield projection of 23.9 bushels per acre is lower than any other yield projection shown in table 44. FAO does not specify what yields they assume for any grain other than wheat. Beef and pork production projections are very close to the OECD projections.

Domestic disappearance.--FAO projections of per capita domestic disappearance of wheat and beef assume less response to economic growth than do CDA and OECD projections. Thus, the FAO projection of per capita wheat consumption is higher than CDA and OECD projections, while the beef-plus-veal projection is lower.

ERS

Methodology.--The ERS projections are from a study of 1980 world demand prospects for wheat, rice, and coarse grains (155). The study, which was sponsored by the Agency for International Development, examines the export earnings potential of less developed countries. Canadian supply, demand, and trade projections were made only when needed to analyze world market conditions for the commodities under consideration. The study assumed 1980 population and national income projections for Canada of 26 million people and US$50.6 billion (1958 base).

Interrelationships between wheat, rice, and coarse grains are examined and the 1980 world supply-demand situation is projected under three sets of alternatives. The projections shown in tables 44, 45, and 46 were based on the alternative that assumes a continuation of recent LDC production trends and that major exporters would adjust their exports downward to maintain world price levels.

Production.--The ERS study projected Canada's 1980 wheat production at 683 million bushels, which is larger than the 1969 level shown in the study for purposes of comparison. Yield and acreage projections were not made.

Domestic disappearance.--The study projected 1980 domestic disappearance of wheat to be 157 million bushels, which is very close to the low CDA projection. Domestic disappearance of coarse grains was projected at 17.3 million tons.

Trade.--Canadian wheat exports were projected to be approximately 11.9 million tons in 1980 and coarse grain exports, 1.1 million tons. Under the assumption of 46 bushels per ton (48 pounds per bushel), the coarse grains export projection is 50.6 million bushels--roughly one-half the Task Force's 1980 projection but larger than the CDA projection.

Other Studies

Domestic disappearance.--In a 1970 study, Zenon Yankowsky (one of the authors of the 1968 CDA projections) makes projections of meat consumption (190). He uses more recent data and slightly different techniques than used in the CDA study to revise per capita meat consumption estimates. Yankowsky's work indicated that meat consumption was rising more rapidly than previously estimated. In addition, he projected increases in per capita pork consumption, something most of the other projections did not do.

Exports.--Wheat export projections from three other studies are shown in table 46. Bjarnason, using FAO trade projections plus research from his Ph.D. thesis, projects that Canada's 1980 wheat exports will surpass 700 million bushels, a quantity almost twice as large as the Task Force projection (17; 18). Hudson, using projections by FAO, OECD, and Yankowsky, projects a 1975 wheat export level similar to the 1980 Task Force projection (95). Hudson's 1975 barley export projection was larger than that of the Task Force. Huff used mainly FAO trade projections coupled with information on Canada's historical share of the market to project a range for 1975 trade (96). The midpoint of that range, 235 to 285 million bushels, is the lowest of the wheat export projections shown in table 46.

Projections, Current Study

Assumptions

Prices.--Projections are made under two alternatives. Alternative A assumes a continuation of recent, 1967-69 price levels. Alternative B assumes a gradual decline in the price of all cereals, such that by 1975 the price level is 15 percent below the level assumed under alternative A.

Policy.--It is assumed that Government policy to balance wheat supply with demand will continue, specifically a general de-emphasis of wheat production and the forage program which offers incentives to convert up to 4 million acres of Prairie grainland to perennial forage. It is assumed that in conjunction with programs to eliminate the competitive advantage of wheat relative to other grains, livestock production will be promoted. However, these policies will not change the structure of the livestock industry to a degree sufficient to invalidate the supply-response variables identified in chapter V.

A third basic policy assumption, which runs counter to the other two, is a continuation of various incentives to develop new land. Many of these incentives are provided by the Provincial governments and no major pressure is in evidence for their removal.

Markets.--The emphasis of the projections, as throughout this study, is on supply rather than demand. Although the projected producer prices for cereals and livestock imply both a domestic wholesale price and a world price, it is assumed that domestic and world demand for cereals will be sufficient to absorb production at the implied prices.

Markets for crops other than wheat and the common coarse grains are, with the exception of rapeseed, assumed to remain at pre-1970 price and relative demand levels.

The market for rapeseed is assumed to be expanding but at a slower rate that in the 1968-70 crop years.

Markets for pork and beef are assumed to be open and to operate in the same manner as they did in the 1960's. Thus, the United States will be available as an outlet for feeder cattle and specialty pork products, but most meat will still be slaughtered and consumed within Canada.

Average 1967-69 prices were used for projection purposes. As indicated in table 47, these recent prices for cereals have been generally lower than average 1955-69 prices, while those for livestock have been higher. Corn is an exception in that its recent price equals the long-term average price. The recent hog-barley ratio is approximately 10 percent above the 1955-69 average.

Table 47.--Average prices of selected farm commodities, Canada, 1967-69 and 1955-69

Commodity	1967-69	1955-69
	Canadian dollars	
Wheat	1.66	1.73
Barley	1.03	1.11
Oats	0.72	0.74
Corn	1.32	1.32
Pork	30.85	27.19
Feeder steers	28.01	22.26
Slaughter steers	27.96	23.78
Cows	21.15	16.41
	Ratio	
Hog/barley ratio	21.7	19.7

Source: Tables 38-42.

Technology.--As indicated in chapter IV, only moderate improvements in agricultural technology are expected in Canada before 1975. For projection purposes, it is assumed that crop yields will continue to advance at approximately the same rate as through the 1960's. In beef production, average carcass weight will continue to increase but not as fast as it did during the past decade.

Methodology and Results

Wheat.--Because the assumed wheat price is not much lower than the long-term average price (table 47), past trends in wheat acreage might be expected to continue. However, in 1970 and to a lesser extent in 1969, wheat acreage did adjust downward; consequently, projecting from past trends is not reasonable.

The wheat area projection shown in table 48 under alternative A is the wheat area trend value of 29.5 million acres (app. table 2) adjusted downward by 5 million acres. The adjustment figure is the sum of half the increase in rapeseed area during 1970-75 (projected to move from 4 to 6 million acres) plus the whole of the 4 million-acre forage program. Such reasoning involves the assumptions that (1) half the increase in rape area is drawn from what normally would be wheat, and (2) increased emphasis on

Table 48.--Projections of area, yield, production, domestic disappearance, and implied export availability for selected agricultural commodities under two alternative grain price levels, Canada, 1975

Category	Wheat	Barley	Oats	Corn	Beef	Pork
	Million acres				1,000 head	
Area and livestock numbers:						
1967-69 average	28.2	8.8	7.5	0.9	3,310	9,039
Alternative A 1/	24.5	11.6	5.9	1.5	3,881	9,767
Alternative B 2/	22.1	11.6	5.9	1.3	3,881	10,465
	Bushels per acre				Carcass wt.	
Yield 3/:						
1967-69 average	22.8	36.0	45.8	81.3	543	129
Alternative A	27.6	45.4	49.4	94.5	565	129
Alternative B	24.7	37.8	47.2	80.2	565	129
	Million bushels				Million lbs.	
Production:						
1967-69 average	642	317	346	76	1,798	1,166
Alternative A	676	527	291	142	2,193	1,260
Alternative B	546	439	279	104	2,193	1,350
Domestic disappearance:						
1967-69 average	168	242	331	108	1,795	1,102
Alternative A 4/	186	338	289	157	2,282	1,246
Alternative B 5/	186	367	279	157	2,282	1,246
Export availability:						
1967-69 average 6/	474	75	15	7/(32)	3	64
Alternative A	490	189	2	(15)	(89)	14
Alternative B	360	72	0	(53)	(89)	104

1/ Assumes that recent (1967-69 average) price levels will prevail through 1975.

2/ Assumes 1975 grain price levels are 15 percent below recent levels, while recent livestock prices are maintained.

3/ Crop yields under alternative A are based on a modified 1960-70 yield trend. Under alternative B, the 1966-70 average yield was used. Carcass weight for beef is a modified 1955-69 trend, while for pork the 1967-69 average is used.

4/ Projections were taken from the OECD study (146) for wheat and from the Yankowsky (190) study for meat. Projections for coarse grains were made by extension of the 1960-69 trend.

5/ Projections for wheat, corn, and meat are taken from domestic disappearance projections under alternative A. Barley and oats projections are based on domestic disappearance projections under alternative A, with adjustments made for the shortfall in oats production and increased feed requirements due to increased pork production.

6/ Figures given represent export availability, not actual exports or imports.

7/ Numbers in parentheses indicate net imports.

Source: Authors' calculations.

feed grain production (de-emphasis of wheat) will induce farmers to withdraw wheat area rather than feed grain area when they participate in the forage program. Support for the projection of 24.5 million acres of wheat in 1975 comes from Hudson (95), who suggests that 23 million acres will be an adequate area to devote to wheat in 1975.

The wheat area projection under alternative B, which assumes that grain prices decline 15 percent by 1975, was calculated using a supply elasticity estimate of 0.69, the simple average of the elasticity estimates from equations (1), (3), and (5) in chapter V (p. 81).

The 1975 wheat yield projection under alternative A is based on a modification of the 1960-70 trend. 40/ It is assumed that increased fertilizer use and adoption of higher yielding varieties will proceed at about the same rate as during the last decade. The wheat yield projection under alternative B is the 5-year, 1966-70 average yield, which implies little or no adoption of yield-increasing input factors.

The wheat production projections are the product of the area and yield projections. The projection of domestic disappearance is the OECD projection (table 45). Since the price elasticity of demand for wheat is small, no modifications were made between the two alternatives in projecting domestic disappearance. Export availability (production minus domestic disappearance) under alternative A is below the 1980 trade projections of CDA and Bjarnason (table 46) but higher than projections by the Task Force, Hudson, Huff, and the ERS study. Under alternative B, export availability is very close to the trade projections of the Task Force for 1980 and Hudson for 1975.

Barley and oats.--Acreage projections under alternative A are linear extrapolations of the 1960-69 trend (table 48). The projections under alternative B are calculated from equation (11) in chapter V (p. 83). Under the assumption that the area planted to barley and oats changes proportionately, equation (11) indicates two components of change for alternative B. The first is a tendency to decrease acreage in response to the lower prices--an estimated 1.5 million-acre decrease. The second is a tendency to increase feed area because of decreased wheat area--an estimated 1.6 million-acre increase in area. Since the two components nearly cancel each other out, the projected feed area under alternative B is the same as under alternative A.

Yield projections for barley and oats under alternative A are extensions of the modified 1960-70 trend. 41/ Yield projections under alternative B are 1966-70 average yields, which imply little or no change in technology.

Production under both alternatives is projected yield multiplied by projected area. Domestic disappearance projections for the individual feed grains were not made by OECD, the source used for wheat; consequently, alternative A projections were made by extrapolation of the 1960-70 trend. Individual projections were made for oats and barley. Projection of domestic disappearance for barley is similar to CDA's 1980 projection, while for oats the projection is considerably lower.

Domestic disappearance of feed grains under alternative B is higher than that under alternative A because hog feed requirements are estimated to be 19 million bushels

40/ The modification was to exclude the 1961 yield from the series because this extremely low yield in the early part of the series resulted in a larger slope on the trend line than the rest of the series indicated.

41/ See footnote 40, which also applies here.

higher. 42/ Since most increased hog production will be in the Prairie Provinces, all of the increase in feed requirements was allocated to barley and oats. Domestic disappearance of barley is projected to increase 29 million bushels over alternative A, and that of oats, to decrease by 10 million bushels.

The 1975 export availability projection for barley under alternative A is nearly double the Task Force's 1980 estimate for all coarse grains (table 46). The projection under alternative B is between the 1980 CDA and Task Force estimates for all coarse grains.

Corn.--Corn acreage under alternative A was projected by linear extension of the 1960-70 trend line. Our projection, shown in table 48, is larger than either of the corn area projections shown in table 44. However, the Task Force projected 1.5 million acres of corn in eastern Canada in 1980 (49, p. 256) and the recent rate of expansion indicates the Task Force's projection may be reached before 1980. Equations (12) and (13) in chapter V (p. 84) indicates that the supply elasticity of corn was approximately 1.0. Thus, the 15-percent price decline under alternative B would carry with it a 15-percent decline in acreage.

Corn yield under alternative A was projected by extension of the 1960-70 trend. A steady decline in price would probably cause a break in the increasing use of improved technology; consequently, 1975 yields under alternative B were assumed to stay at 1966-70 average yield levels. Production is the product of projected area and yield. Domestic disappearance under both alternatives is a linear extension of the 1960-69 trend. The projection of import requirements under alternative A is reasonably close to the Task Force's 1980 trade projection.

Beef.--Projecting 1975 beef production under alternative A from the equations developed in chapter V was a two-step process. Since beef production is a multiyear process, the first step was a projection of beef cow numbers. The second step was projection of beef production as a function of beef cow numbers.

Extrapolation of the 1955-69 trend variable (see equation (16), p. 86) to reflect probable beef cow number increases under constant prices indicates that the number on farms in 1973 would be 3,440,000 head. However, it appears that for the next 2 or 3 years, beef cow numbers will probably increase faster than extrapolation of the trend would indicate. After a period of draw-down during 1965-68, the number of cows on farms on December 1, 1970, was estimated to be 6.4 percent above 1969 levels and beef heifer numbers were estimated to be up even more sharply (47, p. 6). Hence, for our projection we made an upward adjustment by using the average percentage rate of increase for those 12 years during 1955-69 when increases took place. Three years of this rate--5.2 percent--is a 16.4-percent increase over the 1970 base, which gives a projection of 3,608,000 beef cows in 1973. Based on this cow population, 1975 beef production was projected by equation (14) (see p. 86) to be 2,193 million pounds on a carcass-weight basis--which is a little larger than the OECD projections for the same year. Production under alternative B is the same as under alternative A because neither Kerr's regional analysis nor our national analysis resulted in an adequate means to estimate supply response to feed price changes.

42/ The increase in feed requirements due to the projected increase in hog slaughtering under alternative B is calculated as follows: The 1965-69 average ratio of the number of hogs on farms (1,000 head) on June 1 to total pork production (million pounds) is 5.1. Thus, an increase of 104 million pounds of pork implies an increase of 530,000 head on June 1. Using the same conversion factor as the Task Force, we estimate that a grain-consuming animal unit consumes 0.9 ton of feed a year, while a hog (on June 1) is considered equivalent to 0.87 animal units. The result is the estimate that 0.78 tons of feed are required annually per hog on farms. This translates into 413,000 tons or 19.0 million bushels of barley.

Projecting average carcass weight by extending the 1960-69 trend to 1975 results in a projection of 578 pounds; however, that projection was adjusted downward to 565 pounds because future increases in fed beef production will probably not be as rapid as in the past (44, p. 112). The projection of 565 pounds is larger than the 1980 CDA projection. Again, no change was made between alternatives A and B. The number of head slaughtered was calculated from the production and yield projections.

The domestic disappearance projection shown on table 48 is the most recent projection made by Zenon Yankowsky of the Canada Department of Agriculture (190). Combining the projected levels of production and domestic disappearance of beef results in a deficit of 89 million pounds under both alternatives.

Pork.--Unlike beef production, pork production is able to adjust rapidly to meet changing economic conditions. Consequently, realism dictates that pork production projections be based more on economic conditions and less on inventory constraints and trends. Under alternative A, all prices were assumed to remain at 1967-69 levels, which implies a hog-barley ratio of 21.73 and a slaughter steer price of Can$27.96 per cwt. (table 47). Inserting these two assumptions in equation (19) gives a 1975 pork production projection of 1,260 million pounds--very close to FAO and OECD projections.

Under alternative B, the price of barley changes but that of hogs does not. Thus, the hog-barley ratio rises to 25.5, an increase of 17.6 percent. Applying the supply elasticity of the hog-barley ratio from equation (19) gives a 1975 supply increase of 7.2 percent and a new projection of 1,350 million pounds--very close to the 1980 CDA projection.

According to CDA, average carcass weight will fall to 127 pounds by 1980, while the Task Force projects an increase to 135 pounds. We use the 1967-69 average of 129 pounds as a basis for calculating the 1975 level under both alternatives.

Our 1975 projection of domestic disappearance is taken from the projections made by Yankowsky (table 45). The projection of 1,246 million pounds is 6 million pounds less than the OECD projection for the same year.

As projected, domestic production and disappearance result in a 1975 pork market that is almost in balance under alternative A. However, under alternative B, which basically is a cheap feed assumption, export availability goes from a small deficit to a surplus amounting to approximately 8 percent of domestic disappearance.

Appendix table 1.--Production of principal grain crops, by region, 1960-70

Commodity and region	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970
	1,000 bushels										
Wheat:											
Manitoba	66,000	34,000	80,000	61,000	85,000	79,000	79,000	90,000	91,000	64,000	30,500
Saskatchewan	327,000	137,000	354,000	493,000	348,000	400,000	537,000	339,000	372,000	461,000	210,000
Alberta	105,000	89,000	112,000	149,000	145,000	153,000	191,000	145,000	166,000	140,000	72,000
Prairie Provinces	498,000	260,000	546,000	703,000	578,000	632,000	807,000	574,000	629,000	665,000	312,500
Ontario	17,968	20,447	16,232	18,185	18,685	13,723	15,827	15,844	15,208	14,570	15,854
Other Canada	2,411	2,947	3,322	2,315	4,041	3,689	4,511	3,076	5,636	4,706	3,165
Total Canada	518,379	283,394	565,554	723,500	600,726	649,412	827,338	592,920	649,844	684,276	331,519
Barley:											
Manitoba	24,000	9,000	21,000	16,000	16,000	22,000	28,000	33,000	43,000	42,000	51,000
Saskatchewan	68,000	20,000	48,000	78,000	34,000	65,000	96,000	63,000	80,000	109,000	142,000
Alberta	95,000	77,000	89,000	119,000	107,000	115,000	159,000	134,000	178,000	204,000	198,000
Prairie Provinces	187,000	106,000	158,000	213,000	157,000	202,000	283,000	230,000	301,000	355,000	391,000
Ontario	3,303	3,342	3,639	3,966	6,342	9,594	11,236	13,196	16,320	15,750	17,353
Other Canada	3,170	3,298	4,249	4,269	5,121	6,706	6,999	5,466	8,053	7,633	7,351
Total Canada	193,473	112,640	165,888	221,235	168,463	218,300	301,235	248,662	325,373	378,383	415,704
Oats:											
Manitoba	56,000	24,000	89,000	62,000	73,000	74,000	64,000	66,000	81,000	69,000	53,000
Saskatchewan	95,000	19,000	110,000	118,000	54,000	94,000	93,000	49,000	74,000	107,000	110,000
Alberta	93,000	86,000	123,000	124,000	79,000	104,000	101,000	80,000	94,000	102,000	117,000
Prairie Provinces	244,000	129,000	322,000	304,000	206,000	272,000	258,000	195,000	249,000	278,000	280,000
Ontario	82,335	89,879	100,346	91,663	80,864	77,816	59,243	58,374	58,745	42,768	43,650
Other Canada	72,170	65,086	70,264	50,214	60,142	50,167	57,435	50,804	54,771	50,619	44,200
Total Canada	398,505	283,965	492,610	445,877	347,006	399,983	374,678	304,178	362,516	371,387	267,850
Corn:											
Prairie Provinces	179	123	132	180	125	150	130	275	100	64	140
Ontario	25,920	29,085	33,267	36,004	52,715	59,348	65,081	72,250	78,533	69,843	93,500
Other Canada	--	--	--	--	--	--	1,117	1,558	2,535	3,519	6,708
Total Canada	26,099	29,208	33,399	36,184	52,840	59,498	66,328	74,083	81,168	73,426	100,348

-- means zero or less than one-half a unit.

Source: (216).

Appendix table 2.--Acreage seeded to principal grains and competing crops, by region, Canada, 1960-70

Commodity and region	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1970 1/
						1,000 acres						
Wheat:												
Manitoba	2,800	2,914	3,042	3,153	3,385	3,240	3,255	3,520	3,400	2,500	1,400	3,229
Saskatchewan	15,800	16,082	17,388	17,910	19,200	18,500	19,405	19,670	19,000	16,600	8,000	19,383
Alberta	5,300	5,633	5,807	5,933	6,495	6,050	6,506	6,380	6,460	5,300	2,600	6,297
Prairie Provinces	23,900	24,629	26,237	26,996	29,080	27,790	29,166	29,570	28,860	24,400	12,000	28,930
Ontario	542	581	468	459	472	376	363	413	366	369	364	316
Other Canada	141	106	112	114	146	135	164	138	197	199	120	192
Total Canada	24,583	25,316	26,817	27,569	29,698	28,301	29,693	30,121	29,423	24,968	12,484	29,439
Barley:												
Manitoba	930	655	629	584	497	601	875	970	1,170	1,200	1,500	1,101
Saskatchewan	2,450	1,839	1,629	1,930	1,400	1,750	2,255	2,350	2,510	2,700	3,300	2,477
Alberta	3,300	2,867	2,839	3,408	3,320	3,390	3,880	4,280	4,650	5,100	4,700	4,949
Prairie Provinces	6,680	5,361	5,097	5,922	5,217	5,741	7,010	7,600	8,330	9,000	9,500	8,528
Ontario	83	78	81	89	140	195	265	285	300	315	335	350
Other Canada	94	90	109	166	138	185	186	230	207	220	208	238
Total Canada	6,857	5,529	5,287	6,177	5,495	6,121	7,461	8,115	8,837	9,535	10,043	9,138
Oats:												
Manitoba	1,500	1,300	1,794	1,620	1,635	1,525	1,530	1,600	1,580	1,530	1,260	1,485
Saskatchewan	2,524	1,492	2,712	2,216	1,469	1,920	1,838	1,530	1,800	2,100	1,950	1,769
Alberta	2,320	2,330	2,646	2,424	1,950	2,200	2,082	1,960	1,960	2,000	2,050	1,924
Prairie Provinces	6,344	5,122	7,152	6,260	5,054	5,645	5,450	5,090	5,340	5,630	5,260	5,183
Ontario	1,650	1,794	1,848	1,756	1,520	1,370	1,219	1,083	984	810	750	768
Other Canada	1,626	1,627	1,591	1,322	1,410	1,347	1,255	1,263	1,232	1,215	1,139	1,119
Total Canada	9,620	8,543	10,591	9,338	7,984	8,362	7,924	7,436	7,556	7,655	7,149	7,065
Corn:												
Prairie Provinces	5	4	3	4	5	6	3	5	2	3	4	--
Ontario	450	396	436	548	650	740	786	850	925	930	1,100	1,056
Other Canada	1	--	--	1	--	--	18	21	31	45	86	69
Total Canada	456	400	439	553	655	746	807	876	958	978	1,190	1,112
Flaxseed:												
Manitoba	707	748	703	757	1,025	1,350	1,107	660	820	1,100	1,150	
Saskatchewan	1,209	941	389	490	521	560	429	193	397	770	1,500	
Alberta	565	362	299	300	370	355	347	145	285	450	700	
Prairie Provinces	2,481	2,051	1,391	1,547	1,916	2,265	1,883	998	1,502	2,320	3,350	
Ontario	20	21	21	21	23	20	14	7	6	3	2	
Other Canada	7	3	3	2	8	30	21	18	16	18	16	
Total Canada	2,508	2,075	1,415	1,570	1,977	2,315	1,918	1,023	1,524	2,341	3,368	
Rapeseed:												
Manitoba	33	29	25	27	84	145	170	145	91	196	350	
Saskatchewan	550	374	167	220	303	555	731	600	511	1,000	2,000	
Alberta	180	307	212	184	404	735	624	875	450	816	1,600	
Prairie Provinces	763	710	404	431	791	1,435	1,525	1,620	1,052	2,012	3,950	
Ontario	--	--	--	--	--	--	--	--	--	--	--	
Other Canada	--	--	--	--	--	--	--	--	--	--	--	
Total Canada	763	710	404	431	791	1,435	1,525	1,620	1,052	2,012	3,950	
Soybeans 2/	226	212	221	236	231	265	279	290	295	322	335	
Rye:												
Manitoba	83	80	111	110	133	133	100	141	120	183	194	
Saskatchewan	265	239	279	293	320	410	398	327	385	496	535	
Alberta	142	174	209	208	182	200	172	160	114	180	215	
Prairie Provinces	490	493	599	611	635	743	670	628	619	859	944	
Ontario	65	62	63	75	56	50	47	59	52	60	62	
Other Canada	6	6	6	5	5	6	9	8	8	8	9	
Total Canada	561	561	668	691	696	799	726	685	679	927	1,015	
Tame hay:												
Manitoba	934	1,004	1,045	1,039	990	960	1,065	1,052	940	1,000	1,160	1,058
Saskatchewan	1,010	1,052	1,052	1,061	1,165	1,190	1,246	1,100	1,100	1,200	1,600	1,336
Alberta	2,200	2,477	2,626	2,564	2,652	2,864	2,938	2,875	2,740	2,900	3,400	3,155
Prairie Provinces	4,144	4,533	4,723	4,664	4,807	5,014	5,249	5,027	4,780	5,100	6,160	5,549
Ontario	3,400	3,281	3,306	3,164	3,356	3,381	3,418	3,440	3,250	3,150	3,000	3,192
Other Canada	4,562	4,415	4,400	4,524	4,450	4,420	4,487	4,435	4,408	4,356	4,460	4,408
Total Canada	12,106	12,229	12,429	12,352	12,613	12,815	13,154	12,902	12,438	12,606	13,620	13,149
Fodder corn:												
Prairie Provinces	29	33	41	43	54	50	43	33	35	28	24	33
Ontario	282	269	300	297	380	420	454	480	500	550	565	571
Other Canada	55	58	57	56	63	71	81	83	95	104	112	106
Total Canada	366	360	398	396	497	541	578	596	630	682	701	710
Total forage crops: 3/												
Manitoba	961	1,035	1,083	1,080	1,039	1,004	1,102	1,078	969	1,023	1,180	1,085
Saskatchewan	1,012	1,054	1,055	1,063	1,170	1,196	1,252	1,107	1,106	1,205	1,604	1,336
Alberta	2,200	2,477	2,626	2,564	2,652	2,864	2,938	2,875	2,740	2,900	3,400	3,155
Prairie Provinces	4,173	4,566	4,764	4,707	4,861	5,064	5,292	5,060	4,815	5,128	6,184	5,582
Ontario	3,682	3,550	3,606	3,461	3,736	3,801	3,872	3,920	3,750	3,700	3,565	3,763
Other Canada	4,617	4,473	4,457	4,580	4,513	4,491	4,568	4,518	4,503	4,460	4,572	4,514
Total Canada	12,472	12,589	12,827	12,748	13,110	13,356	13,732	13,498	13,068	13,288	14,321	13,859

-- means zero or less than one-half a unit.

1/ Estimate based on 1960-69 trend for grains and 1960-70 trend for forages. 2/ All in Ontario. 3/ Tame hay plus fodder corn.

Source: (216).

Appendix table 3.--Number of livestock on farms, by type of animal and region, Canada, 1960-70 1/

Class and region	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1970 2/
						1,000 head						
All cattle:												
Manitoba.	897	881	957	1,030	1,095	1,055	1,020	968	911	995	1,040	1,017
Saskatchewan. . .	1,831	1,800	1,851	2,004	2,125	2,090	2,015	1,945	1,835	1,987	2,136	2,019
Alberta	2,449	2,509	2,587	2,845	3,055	3,100	3,090	3,081	2,990	3,100	3,255	3,296
Prairie Provinces	5,177	5,190	5,395	5,879	6,275	6,245	6,125	5,994	5,736	6,082	6,431	6,332
Ontario	3,017	3,198	3,281	3,202	3,248	3,136	3,161	3,297	3,225	3,175	3,164	3,242
Other Canada. . .	2,502	2,545	2,547	2,597	2,605	2,521	2,463	2,484	2,514	2,571	2,622	2,522
Total Canada.	10,696	10,933	11,223	11,678	12,128	11,902	11,749	11,775	11,475	11,828	12,217	12,096
Nondairy cattle:												
Manitoba.	703	691	780	858	930	899	876	831	783	875	921	905
Saskatchewan. . .	1,596	1,564	1,640	1,807	1,945	1,931	1,870	1,810	1,717	1,877	2,031	1,930
Alberta	2,171	2,227	2,311	2,569	2,786	2,845	2,848	2,865	2,785	2,900	3,063	3,102
Prairie Provinces	4,470	4,482	4,731	5,234	5,661	5,675	5,594	5,506	5,285	5,652	6,015	5,937
Ontario	2,043	2,213	2,324	2,276	2,323	2,217	2,249	2,367	2,325	2,300	2,322	2,368
Other Canada. . .	1,262	1,302	1,315	1,374	1,383	1,314	1,272	1,284	1,293	1,350	1,409	1,322
Total Canada.	7,775	7,997	8,370	8,884	9,367	9,206	9,115	9,157	8,903	9,302	9,746	9,626
Beef cows:												
Manitoba.	220	231	251	284	315	318	298	328	311	330	355	355
Saskatchewan. . .	611	643	681	740	806	820	802	830	802	830	880	891
Alberta	817	858	877	904	955	992	972	1,056	1,020	1,080	1,155	1,108
Prairie Provinces	1,648	1,732	1,809	1,924	2,076	2,130	2,072	2,214	2,133	2,240	2,390	2,354
Ontario	296	318	344	352	355	342	325	365	360	375	383	377
Other Canada. . .	237	254	278	339	410	455	485	281	279	301	330	374
Total Canada.	2,181	2,304	2,431	2,619	2,841	2,927	2,882	2,860	2,772	2,916	3,103	3,105
Steers:												
Manitoba.	91	75	99	97	102	90	96	99	87	105	95	101
Saskatchewan. . .	146	121	135	144	137	135	143	149	123	145	155	140
Alberta	210	219	247	276	286	310	320	350	337	365	320	388
Prairie Provinces	447	415	481	517	519	535	559	598	547	615	570	629
Ontario	427	459	525	540	565	555	590	575	550	500	530	585
Other Canada. . .	102	114	105	111	123	111	112	116	117	118	122	120
Total Canada.	976	988	1,111	1,168	1,207	1,201	1,261	1,289	1,214	1,233	1,222	1,334
Hogs:												
Manitoba.	379	407	349	430	460	456	556	576	550	775	990	696
Saskatchewan. . .	503	577	400	472	544	431	530	549	548	765	1,130	630
Alberta	1,342	1,402	1,101	1,183	1,401	1,103	1,238	1,319	1,240	1,410	1,780	1,288
Prairie Provinces	2,224	2,386	1,850	2,085	2,405	1,990	2,324	2,444	2,338	2,950	3,900	2,614
Ontario	1,728	1,627	1,956	1,969	1,908	1,854	2,015	2,100	2,020	2,100	2,210	2,158
Other Canada. . .	1,049	1,105	1,187	1,338	1,283	1,244	1,444	1,514	1,337	1,408	1,591	1,519
Total Canada.	5,001	5,118	4,992	5,392	5,596	5,088	5,783	6,058	5,695	6,458	7,701	6,289

1/ Dec. 1 estimates.
2/ Estimate based on 1960-70 trend.

Sources: (208; 216).

Appendix table 4.--Commercial marketings of cattle, calves, and hogs, by region, Canada, 1960-70

Class and region	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1970 1/
	1,000 head											
Cattle:												
Manitoba.	230	291	220	257	290	363	351	335	321	299	330	354
Saskatchewan. . .	471	583	508	468	539	705	703	669	633	543	535	671
Alberta	826	882	876	865	968	1,163	1,207	1,182	1,298	1,240	1,182	1,364
Prairie Provinces	1,527	1,756	1,604	1,590	1,797	2,231	2,261	2,186	2,252	2,082	2,036	2,389
Ontario	737	751	845	882	946	1,078	991	920	987	998	943	1,075
Other Canada. . .	201	217	256	226	245	322	266	229	239	251	264	267
Total Canada.	2,465	2,724	2,705	2,698	2,988	3,631	3,518	3,335	3,478	3,331	3,243	3,732
Calves:												
Manitoba.	87	111	93	90	109	165	156	165	147	94	97	153
Saskatchewan. . .	135	199	214	168	190	251	273	306	275	221	203	295
Alberta	168	222	239	198	219	247	268	242	247	220	194	257
Prairie Provinces	390	532	546	456	518	663	697	713	669	535	494	704
Ontario	225	216	237	240	261	307	255	236	237	215	203	248
Other Canada. . .	328	302	354	350	372	413	411	426	440	457	477	476
Total Canada.	943	1,050	1,137	1,046	1,151	1,383	1,363	1,375	1,346	1,207	1,175	1,427
Hogs:												
Manitoba.	506	519	467	437	582	579	595	766	751	778	1,093	799
Saskatchewan 2/ .	604	586	513	369	508	505	466	598	601	554	872	543
Alberta	1,767	1,660	1,675	1,350	1,554	1,634	1,351	1,564	1,697	1,416	1,648	1,454
Prairie Provinces	2,877	2,765	2,655	2,156	2,644	2,718	2,412	2,928	3,049	2,748	3,613	2,796
Ontario	2,516	2,333	2,402	2,648	2,813	2,638	2,597	2,937	2,838	2,656	2,946	2,876
Other Canada. . .	1,377	1,373	1,541	1,720	1,828	1,727	1,861	2,338	2,272	2,088	2,166	2,379
Total Canada.	6,770	6,471	6,598	6,524	7,285	7,083	6,870	8,203	8,159	7,492	8,725	8,051

1/ Estimates based on 1960-70 trends.
2/ Saskatchewan hog marketings understated because about half of Saskatchewan hogs are marketed in Manitoba (86).

Source: (208).

Appendix table 5.--Average yields per acre of wheat, barley, oats, and corn, by principal producing region, Canada, 1960-70

Commodity and region	1960	1961 1/	1962	1963	1964	1965	1966	1967	1968	1969	1970
	Bushels/acre										
Wheat:											
Manitoba	23.6	11.7	26.3	19.3	25.1	24.4	24.3	25.6	26.8	25.6	21.8
Saskatchewan	20.7	8.5	20.4	27.5	18.1	21.6	27.7	17.2	19.6	27.8	26.2
Alberta	19.8	15.8	19.3	25.1	22.3	25.3	29.4	22.7	25.7	26.4	27.7
Prairie Provinces	20.8	10.6	20.8	26.0	19.9	22.7	27.7	19.4	21.8	27.3	26.0
Canada	21.1	11.2	21.1	26.2	20.2	22.9	27.9	19.7	22.1	27.4	26.6
Barley:											
Manitoba	26.1	13.7	33.4	27.4	32.2	36.6	32.0	34.0	36.8	35.0	34.0
Saskatchewan	27.7	10.9	29.5	40.4	24.3	37.1	42.6	26.8	31.9	40.4	43.0
Alberta	28.7	26.9	31.3	34.9	32.2	33.9	41.0	31.3	38.3	40.0	42.1
Prairie Provinces	28.0	19.8	31.0	36.0	30.1	35.2	40.4	30.3	36.1	39.4	41.3
Canada	28.2	20.4	31.4	35.8	30.7	35.7	40.4	30.6	36.8	39.7	41.4
Oats:											
Manitoba	37.3	18.5	49.6	38.3	44.6	48.5	41.8	41.2	57.3	45.1	42.1
Saskatchewan	37.6	12.7	40.6	53.2	36.8	49.0	50.6	32.0	41.1	51.0	56.4
Alberta	40.3	36.9	46.5	51.2	40.5	47.3	48.5	40.8	48.0	51.0	57.1
Prairie Provinces	38.5	25.2	45.0	48.6	40.8	48.2	47.3	38.3	46.6	49.4	53.2
Canada	41.4	33.2	46.6	47.7	43.5	47.8	47.3	40.9	48.0	48.5	51.5
Corn:											
Ontario	57.6	73.4	76.3	65.7	81.1	80.2	82.8	85.0	84.9	2/75.1	85.0
Canada	57.3	73.0	76.0	65.5	80.7	79.8	82.2	84.6	84.8	2/75.0	84.4

1/ A drought year in the Prairie Provinces.
2/ Low yields due to poor weather.

Source: (216).

Appendix table 6.--Grain seed purchases per acre seeded, by region, Canada, 1960-69

Commodity and region	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969
	Canadian dollars									
Wheat:										
Manitoba	0.19	0.21	0.22	0.21	0.24	0.27	0.29	0.28	0.31	0.43
Saskatchewan	.18	.16	.14	.12	.10	.10	.08	.07	.06	.14
Alberta	.18	.16	.14	.13	.11	.11	.09	.08	.07	.21
Prairie Provinces	.18	.17	.15	.14	.12	.12	.11	.10	.09	.19
Ontario	.18	.15	.17	.16	.14	.15	.13	.10	.09	.18
Other Canada	.13	.17	.16	.16	.12	.13	.11	.13	.09	.18
Total Canada	.18	.17	.15	.14	.12	.12	.11	.10	.09	.19
Barley:										
Manitoba	.21	.35	.42	.52	.68	.62	.47	.47	.42	.60
Saskatchewan	.21	.27	.30	.25	.35	.28	.21	.20	.19	.48
Alberta	.22	.25	.25	.21	.21	.21	.18	.17	.15	.34
Prairie Provinces	.21	.27	.30	.25	.29	.27	.23	.23	.20	.41
Ontario	.22	.30	.35	.38	.28	.23	.19	.19	.20	.41
Other Canada	.23	.27	.25	.18	.23	.18	.19	.17	.20	.41
Total Canada	.21	.27	.29	.25	.29	.27	.23	.21	.20	.41
Oats:										
Manitoba	.04	.11	.12	.18	.23	.29	.34	.38	.43	.40
Saskatchewan	.04	.11	.09	.14	.25	.23	.28	.38	.36	.48
Alberta	.04	.06	.07	.10	.15	.15	.18	.22	.24	.55
Prairie Provinces	.04	.09	.09	.13	.20	.22	.26	.32	.34	.54
Ontario	.04	.06	.08	.10	.13	.17	.22	.28	.34	.48
Other Canada	.06	.08	.11	.16	.18	.22	.27	.30	.34	.48
Total Canada	.04	.08	.09	.13	.19	.21	.25	.31	.34	.48
Corn:										
Ontario	2.27	2.38	2.35	2.57	2.65	3.09	3.10	3.69	4.15	4.56
Total Canada	2.27	2.38	2.36	2.63	2.72	3.17	3.19	3.78	4.19	4.77

Sources: Calculated from Dominion Bureau of Statistics special data and (216).

Appendix table 7.--Pigs saved per sow farrowed, by region, Canada, 1960-70

Region	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970
	Number										
Prairie Provinces	7.69	7.78	7.79	7.71	7.76	7.75	7.79	7.83	7.87	7.93	8.02
Ontario	8.08	8.04	8.08	8.01	8.21	8.13	8.06	8.03	8.02	8.02	8.17
Other Canada	8.15	7.88	8.05	8.11	8.00	8.17	8.09	8.07	8.00	7.92	8.00
Total Canada	7.94	7.89	7.97	7.93	7.98	8.00	7.96	7.96	7.96	7.96	8.06

Sources: (205; 216).

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